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ABSTRACT

Described is the Ohio Watershed Heritage Project. Sections in the publication include the following: (1) history leading to the project; (2) teaching methodology of the program; (3) teacher training; (4) watershed study objectives; (5) local coordinators; (6) evaluation plan; (7) graduate student comments in the program; (8) secondary school teacher comments; (9) secondary student comments; (10) parent comments; (11) observer comments; (12) project dissemination efforts; and (13) adoption and implementation. The project stressed a hands-on learning approach with the emphasis on teaching professionally recognized water quality procedures; these data were provided to the Ohio Environmental Protection Agency (EPA). Accomplishments, problems, and the recommendations for future work are detailed. (RH)

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THE OHIO WATERSHED HERITAGE PROJECT

An Environmental Community Service
for
Secondary School Students

Volume VII of the Environmental Education Guide Series

The Institute for Environmental Education

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Institute for Environmental Education

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THE OHIO WATERSHED HERITAGE PROJECT

An Environmental Community Service for Secondary School Students

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PREFACE

In 1967 teachers and students at University School, Shaker Heights, Ohio began studying the Chagrin River. They asked The Three Rivers Watershed District, a regional water resources planning agency, for technical advice and field training. The students discovered an exciting, challenging, new educational experience and the Watershed District learned that the students' data was accurate and valuable. The University School course was the precursor of the national environmental community service program reported here.

By 1974 sufficient knowledge, instructional materials, financial support and national commitment was acquired to dare a large-scale test of that model. In five geographically separate regions a State University, several secondary schools and the Ohio Environmental Protection Agency commenced a water monitoring plan. Before the first of a four-year development period concluded, Oregon initiated the model in Portland and the American Revolution Bicentennial Administration awarded the Ohio Watershed Heritage Project national recognition and urged its incorporation throughout the country.

This publication is a report of the first year's experiences.

ACKNOWLEDGEMENTS

The Officers of the Institute for Environmental Education would like to recognize the singularly foresighted and creative staff of the U. S. Environmental Protection Agency and the Office of Environmental Education (HEW). Directing programs under entirely separate legislation, over a number of years, they united their respective environmental and educational responsibilities into a single, high impact environmental education project. Knowing that no one person coordinated all the decisions we would like to direct our thanks to all of those involved who understood the objectives of the project and helped us achieve them including our grants officers listed chronologically: Robert Snider, Bernard Lukco, Joseph Bahnick, Ben Gryctko and Roger Brittingham, U. S. EPA and Geroge Lowe, Walter Bogan and Julie Lesceux, OEE.

We acknowledge and admire the position taken and sustained by the Ohio Environmental Protection Agency. Through two political generations the successive Directors, Ira Whitman and Ned Williams, have keystoned the Ohio Watershed Heritage Project. They have asserted that students involved in water quality analysis now increases our assurance of clean water in the future. Their staff, Thomas Birch, Joseph Davidson and Alan Franks have weighed the Agency's immediate needs against the long-term returns expected from the student-experience and have consistently counseled for the future. The value of data accumulated by student teams alone would not justify this position; immediate returns have been meager. We can expect, however, that public knowledge, participation and support of similar projects as a means of attaining future goals is burgeoning as the foresight of these men is recognized.

Director Francis T. Mayo and Public Information Director, Frank Corrado of the U. S. Environmental Protection Agency, Region V, which includes the States of Michigan, Minnesota, Ohio, Illinois, Indiana and Wisconsin, have endorsed and publicized the project through workshops, radio broadcasts and a 16,000 copy special educational issue of Region V's monthly newsletter, "Environment Midwest" appearing in February, 1975.

Region V also granted funds to employ Janet Beck to research information concerning the project in that issue. Janet prepared the draft copy and used that information to assist Kalamazoo College Intern, Greg Cznadel, in designing and testing the principal evaluation questionnaire for this report.

The University professors and their graduate students were unexpectedly enthusiastic and completely essential to working cooperatively with the Universities and interrelating with the secondary schools. They selected the schools which would participate in the program and succeeded in maintaining classes, schools and regions as cohesive units throughout the year. Many of us owe special thanks to participating professors and graduate students: Dr. William Jackson and Guy Acerra at Bowling Green State University; Dr. Paul Olynyk and Tom McKenney at Cleveland State University; Dr. John Disinger and Jane Adams, Ohio State University; Drs. Ron Schmidt and Michael Smith and Bev Warner at Wright State University; and Drs. Raymond Skinner and John Collier and Matt Ginsburg at Ohio University.

The teachers who served as Institute instructors because of their skills and previous experiences in the earlier "Cuyahoga River Watershed Project" were particularly effective in their contributions as staff members. Nancy Glass from St. Edward's High School provided the only hard data on student performanc reported here. She is a veteran of a dozen Institute workshops in as many States. Ron McEachen steadily reiterated quality control practices and researched the benthic invertebrate index which will be used in the Project's second year. Jack Arnold pretested and modified the evaluation questionnaire with Greg Cznadel. In the second summer, June-August 1975, Nancy and Ron staffed the Ohio workshop. Ron went on to instruct at Portland, Oregon workshops which marked the beginning of the Pacific-Northwest Demonstration Center. Jack decided on marriage and stayed home.

Cherrie Hall, Program Officer of the "Horizons '76" Division, American Revolution Bicentennial Administration, has the responsibility of encouraging and exhorting Americans to undertake projects individually or collectively which manifest the pride, priorities and hopes of their communities. In December 1973 she became aware of the Project through the Conservation Foundation. Collaborating with the U. S. EPA she made it possible for the Project to be demonstrated at EXPO '74 in Spokane, Washington. Through her unrelenting enthusiasm, Cherrie is encouraging every potential donor to finance some aspect of the Project within a community of their choice. The Project's national dissemination will be determined largely by Cherrie Hall.

Cleveland's foundations - the George Gund Foundation, Kent Smith Family and Leland Schubert Foundation, in the past year, and the Cleveland and Jennings Foundations, in the two preceding years, have matched federal grants right down the line. Their staff, particularly James Lipscomb of the Gund Foundation, struggled to help us clarify and describe the needs, responsibilities and expected benefits of a complex plan in order to justify funding. They were endlessly patient and instructive ultimately making it possible for the foundations' grant review committees to understand and support this Project.

Lastly, I have more personal acknowledgements. The unique synthesis of federal agencies, universities, secondary schools and the Ohio EPA - in five completely different regions - was the creative act of the Project Director, my colleague and much-respected friend, Tom Offutt. Without his empathy there could not have been understanding.

These few and many more people are the Project. There is a mysterious electricity among them, an excitement, a quality of adventure and fun and honesty. Inexplicably, but intuitively, we know that the Project touches and that we are touched by ... nice people.

Joseph H. Chadbourne

SPONSORING ORGANIZATIONS AND PARTICIPANT INSTITUTIONS

PROJECT SPONSORS:
American Revolution Bicentennial Administration
U. S. Environmental Protection Agency
Ohio Environmental Protection Agency
The George Gund Foundation
The Leland Schubert Foundation
The Kent Smith Family
The Charles E. Merrill Trust

REPORT SPONSOR:
Office of Environmental Education (HEW)

REGIONAL UNIVERSITY AND SCHOOLS:

- Bowling Green State University, Bowling Green, Ohio
  - Scott High School
  - Bowling Green High School
  - Perrysburg High School
  - Whitmer High School
- Cleveland State University, Cleveland, Ohio
  - St. Edward's High School
  - Woodridge High School
  - Berkshire High School
- Ohio State University, Columbus, Ohio
  - Groveport Madison High School
  - Dublin Middle School
  - Whitehall Yearling High School
  - Finland Middle School
  - Norton Middle School
  - Buckeye Junior High School
  - McGuffey Junior High School
  - Brookhaven High School
  - Hastings Junior High School
  - Linden McKinley High School
  - Dominion Junior High School
  - Grandview Heights High School
  - North High School
- Wright State University, Dayton, Ohio
  - Centerville High School
  - Charminade-Julienne High School
  - Yellow Springs High School
  - Belmont High School
  - Wayne High School
  - Weisenborn Junior High School
- Ohio University, Athens, Ohio
  - Federal Hocking Schools
  - Lancaster High School
  - Hocking Technical College
  - Logan High School
  - Logan Junior High School
  - Belpre High School

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CHAPTER I - HISTORY

These introductory remarks are background to the Project. They are my interpretation of events from 1967 to 1974 which give definition to the "Ohio Watershed Heritage Project" Statements are sometimes made in the first person to emphasize the essential subjectivity of the narrative. If there is a significant relationship between the background and facts presented in following chapters a reference is made at that point.

The Ohio Project began at University School in Shaker Heights, Ohio in the Spring of 1967. Jonathan Ingersoll, newly appointed Director of the 1967 Summer School, hovered at my biology lab door, judging the best moment to issue his first directive. He did not know that I, too, was poised toward a new direction: My colleagues and I were disconsolate from teaching out of graduate notes and our students were restive because they wanted to get their hands on real problems. The moment was right - and Jack Ingersoll was a courageous and patient man.

For the next two summers the Summer School was devoted totally to a single program - a firsthand investigation of the natural and human forces that created the current environmental status of the Cleveland metropolitan region. We worked together, teachers and students, throughout a thirty mile radius of University School. We used familiar scientific approaches to study the Cuyahoga River basin's geology, soils, hydrology, plants, and animals. And we examined some of the social systems and politics behind housing developments, land improvement, mining operations, and recreation areas. The investigators examined rocks, sifted dirt, captured insects, weighed vegetation, tested water, constructed maps, photographed, interviewed, argued and cooked out together.

Jack Ingersoll and Headmaster Rowland McKinley applied for experimental funding from the Cleveland and the Gund Foundations. The Cleveland Public Schools and surrounding suburban schools recommended eighty students each of whom Jack interviewed personally. We still hear from them, know that many are now committed to environmental avocation or even vocation - possibly influenced by the summer programs.

One student, Bill Schlesinger, was a student instructor during the first summer. He joined five others that first Fall, 1967 in a sequel plan that we disconsolates had invented under the Science Department Chairmanship of Jack Baker, a 12th grade Applied Science Course. Bill's excitement and skills convinced the other five that the Applied Science Course should focus on water pollution. We teachers teamed as an advisory body and assigned the first test, due before Christmas, to design a water laboratory, research standard analytical techniques and plan a field program for the remainder of the year. The six students contacted The Three Rivers Watershed District (a regional water resources planning agency), learned techniques required by U. S. Public Health Service "Standard Methods", built a laboratory inside a maintenance room, and established water quality study schedules in which the students provided The Three Rivers Watershed District regular data on the Chagrin River. From this start the later "Ohio Watershed Heritage Project" would be problem-centered and student-operated.

It was during this first year of the senior Applied Science Course that nearby Laurel School's Dr. Irene Hall invited her cousin, Robert Snider, to visit her and appraise the Course. Mr. Robert Snider was then Director of the Office of Training Grants, Federal Water Pollution Control Administration, Department of the Interior. FWPCA later became part of the U. S. Environmental Protection Agency and Bob Snider became our grants officer. Snider was surprised by the students' knowledge of (then) "sanitary engineering" and the results which they had achieved. In 1968 there was a critical manpower shortage in sanitary engineering, attributable Bob speculated, to lack of secondary school training in that career field. He seized on the possibility that a course such as this would challenge students to enter the profession. If we could learn how to introduce such courses into other schools, he concluded, a long-range plan would be of great interest to his Office of Training Grants.

We despaired tackling a task of that magnitude and turned more confidently to preparations for the Summer of 1968. Relentlessly, however, coincidence altered our plans. Nearby John Carroll University's Science Department Chairman telephoned to ask if two teacher interns could enroll in our summer course for the field experiences. Immediately two more teachers requested participation and before we could say "no", our first four-man teacher trainee group arrived for the summer.

During that second training session the effectiveness of mixing teachers and students and treating them as colleagues was so pronounced that we have, ever since, insisted on a fifty-fifty distribution of teachers and students in all training situations - both as trainers and trainees.

Realization of Bob Snider's hopes for a national training program moved palpably closer. Peter Mott chaired the Science Section of the National Association of Independent School's Annual Conference that year. He had learned about the University School water studies course. He asked University School to demonstrate a mini-version of the Course in New York City. In mid-March, 1969, University's 12th graders trained Collegiate School's 10th graders; the 10th graders next taught a miscellany of NAIS member teachers - again, using field problems in Central Park, the Hudson River and the East River. At the end of the first two days Cleveland's Three Rivers Watershed District Director, George Watkins, flew to New York City and testified before the teachers to the accuracy and value of the students' data. The workshop teachers promptly requested a summer training workshop for themselves.

Ford Foundation observers Bill Felling and Ned Ames invited us to submit a teacher-training proposal. A year after Bob Snider's proposition we reported that we might now be able to test duplicate the University School course. In 1969-70 and 1970-71 FWPCA matched a Ford Foundation grant enabling us to prepare teachers and students, develop instructional materials and attempt implementation in 20 other schools in a dozen states. The effort was headquartered at Tilton School, Tilton, New Hampshire where the author unaccountably became headmaster and developments preceded formation of the full-time Institute for Environmental Education in Cleveland.

Throughout the two year period, extensive interaction and communications took place among the participants. Interpersonal contact occurred in several ways: at two successive residential summer training sessions at Tilton, through visits by a full-time itinerant interscholastic coordinator, at midyear reunions and frequent telephone conversations. In addition there were monthly newsletters, periodic interchange of curriculum drafts (which were later published as Volume I and II - see inside front cover) and frequent correspondence.

The Tilton teacher:student trainees reported from their schools that implementation was difficult. In 1969 and 1970 their fellow faculty members did not understand what "environmental studies" meant. Surprised, the faculty objected to the apparent disorganization accompanying field studies, lengthy periods that students were away from school - often conflicting with other schedules including athletics - and marked student accomplishment. These teachers seemed threatened. They reacted sometimes with open hostility. At the least they were often unaccommodating. Most of our trainees could not, therefore, arrange the 2-4 hour field period to which they had been accustomed during Tilton's summer sessions. The trainees' departments were jealous of the agreement between the grant administrators and the participating school principals that required expenditure of school monies to match those provided by Tilton from the Ford Foundation and FWPCA grants. Back at school our trainees lacked the reenforcement of interest, knowledge, enthusiasm and single-minded dedication that was so luxuriant in the summer training program. Altogether these difficulties helped to structure the Tilton model into the Cuyahoga River Watershed Project and then later the Ohio Watershed Heritage Project.

After two years the Tilton trainees recommended that in the future we should:

- require 2-5 teacher:student teams from each school to attend any training workshop
- select schools that are close enough to one another to permit frequent trainee interaction forming a "cluster"
- systematize regional meetings by time, place and agenda following the training
- provide an inservice coordinator to: continue inservice supporting instruction, publicize the program, process the data and generally provide continuous assistance.

We accepted their recommendations as criteria for redesign.

For the very next training session in 1971 we selected three regions which contained trainees from the preceding years. These were; Quincy, Massachusetts; Philadelphia, Pennsylvania and Cleveland, Ohio. The National Science Foundation provided funds for workshops at the first two locations and the Office of Environmental Education and the U. S. Environmental Protection Agency for the third cluster. Each of the clusters had a different future.

The Quincy cluster collapsed. After the summer training we could not secure the money to establish an inservice coordinator. Leadership among the ten area high schools was lacking, presumably because no school was prepared to give teachers release time, travel expenses or special allowance to serve the other schools.

The Philadelphia cluster flourishes today. After the summer workshops the two Tilton-trainee workshop leaders, Alan Sexton and Jack Hershey, were hired by Project KARE, a new five-county Title III Office of Education Environmental Service Organization. Al and Jack were able to incorporate the cluster under the Project KARE umbrella. The cluster, in turn, helped shape the KARE program. KARE is still operating and in 1975-76 is disseminating its experiences nationally via the Office of Education's Title III Office of Diffusion Network.

In Cleveland we formed the non-profit Ohio corporation, the Institute for Environmental Education in May 1971 and by the following year officially started a three-year regional cluster, the "Cuyahoga River Watershed Heritage Project". We hired Dr. Peter Gail to coordinate the Project full-time. He obtained an adjunct assistant professorship at Cleveland State University. Peter organized a series of courses at CSU over the three-year period and he employed an assistant and several trained student interns to furnish inservice support to the growing membership. General Motors and the Ford Motor Companies gave the Project two 12-passenger vans; the Office of Environmental Education and the U. S. EPA granted matching funds to the first member schools so that they were adequately supplied with equipment and instructional materials. The Cuyahoga River Watershed Project expanded rapidly over the three years from 9, to 17, to 30 participating schools. At a late 1975 weekend workshop, some 132 teachers attended. The three-years of experiences provided background information for designing the five-cluster Ohio Watershed Heritage Project.

The Cuyahoga Project is self-supporting; Dr. Gail has joined Cleveland State University full-time and the training courses are presently being considered as requirements for a new master's degree program. Our findings, teachers' assessments and student activities developed after Tilton, are included in "The Environmental Education Guide Series" listed on the front cover.

By late 1974 conditions were ideal for another expansion. Congress had written the Environmental Education Act, PL 91-516 and then the Federal Water Quality Amendments Act, PL 92-500. Both called for environmental improvement, education and citizen involvement. The U. S. Environmental Protection Agency asked if trained teachers could contribute to the monitoring requirements of PL 92-500. The five-region "Ohio Watershed Heritage Project" was formed to seek an answer.

CHAPTER II - A TEACHING METHODOLOGY

The purpose of this Project is to demonstrate one way in which a particular teaching methodology can be applied in secondary school classrooms. The methodology originated from the notion that students would be better equipped to handle future problems if lecture topics could be supplemented by field investigations. In this example the topic is environmental quality and the field investigation concerns watershed management.

The demonstration takes place in five Ohio regions. In each region, the component members are a State University, surrounding secondary schools and the Ohio Environmental Protection Agency's District Office. The University faculty instruct and a graduate student organizes the regional program. Teachers and students monitor water quality and develop a watershed management plan with support from the State Agency. The Institute for Environmental Education is funded by the U. S. Environmental Protection Agency to facilitate an optimum design and coordinate the five regions.

The methodology is a systematic process for relating students to activities. It is as "systematic" as a school's football program. The methodology has participants, sequence, rules, time limits, specialization, location, equipment, measurements, assignments, skills, and - similarly - requirements for organization. As a "process", like football it is active and conducted by students; it necessitates planning, execution of specific duties, observation of outcomes; and the process compels constant restructuring of the overall picture.

The application is to a watershed. A watershed is an excellent study subject. It is a product of natural and biological influences. It is accessible to all schools. Watersheds can be discovered, traversed, measured, compared, described, modelled and - in a limited way - managed. Further, each watershed is unique, enormously complicated and little understood. Together these characteristics describe ideal criteria for a study in which classroom lectures and field investigations can be mutually reenforcing.

The Project tasks are to (1) train secondary school teachers to use the teaching methodology, (2) apply it to a watershed study in their region, (3) create a mechanism to sustain the study and, (4) package the training technology for replication elsewhere. The U. S. Environmental Protection Agency has approved the time frame for completion of these tasks from July 1, 1975 - June 30, 1978, three years. Undoubtedly, the availability of funds will alter the rate and extent of progress toward achieving these tasks. The following four chapters detail the accomplishments through the first year.

If the teaching methodology envisioned could be reduced to writing it would resemble the learning theory prepared by Gerald J. Pine and Peter J. Horne quoted here. These authors wrote an article, "For Learning in Adult Education", which was published October 1969 in the periodical Adult Leadership. The article was discovered that fall by Winifred Talbot, Librarian of Tilton School, Tilton, New Hampshire who witnessed the 1969 summer teacher training session and recognized the identity between the session's teaching methodology and the Pine and Horne learning theory.

The significance of their learning theory is that it refines important distinctions about learning principles and conditions. Moreover, their idealized theory may forecast the direction indicated by the Project's proposed teaching methodology. In anticipation of this report permission was requested and received from Gerald J. Pine at the University of New Hampshire and from Adult Leadership magazine to quote verbatim. The entire article is given here except a single, unrelated concluding paragraph.

"PRINCIPLES OF LEARNING

Principle 1.

Learning is an experience which occurs inside the learner and is activated by the learner. The process of learning is primarily controlled by the learner and not by the teacher (group leader). Changes in perception and behavior are more products of human meaning and perceiving rather than any forces exerted upon the individual. Learning is not only a function of what a teacher does to or says to or provides for a learner. More significantly, learning has to do with something which happens in the unique world of the learner. It flourishes in a situation in which teaching is seen as a facilitating process that assists people to explore and discover the personal meaning of events for them.

No one directly teaches anyone anything of significance. If teaching is defined as a process of directly communicating an experience or a fragment of knowledge, then it is clear that little learning occurs as a result of this process and the learning that does take place is usually inconsequential. People learn what they want to learn, they see what they want to see, and hear what they want to hear. Learning cannot be imposed. When we impose ideas on people we train them. When we create an atmosphere in which people are free to explore ideas in dialogue and through interaction with other people, we educate them. Very little learning takes place without personal involvement and meaning on the part of the learner. Unless what is being taught has personal meaning for the individual he will shut it out from his field of perception. People forget most of the content "taught" to them and retain only the content which they use in their work or content which is relevant to them personally.

Principle 2.

Learning is the discovery of the personal meaning and relevance of ideas. People more readily internalize and implement concepts and ideas which are relevant to their needs and problems. Learning is a process which requires the exploration of ideas in relation to self and community so that people can determine what their needs are, what goals they would like to formulate, what issues they would like to discuss, and what content they would like to learn. Within broad programmatic boundaries what is relevant and meaningful is decided by the learner(s), and must be discovered by the learner.

Principle 3.

Learning (behavioral change) is a consequence of experience. People become responsible when they have really assumed responsibility, they become independent when they have experienced independent behavior, they become able when they have experienced success, they begin to feel important when they are important to somebody, they feel liked when someone likes them. People do not change their behavior merely because someone tells them to do so or tells them how to change. For effective learning giving information is not enough, e.g., people become responsible and independent not from having other people tell them that they should be responsible and independent but from having experienced authentic responsibility and independence.

Principle 4.

Learning is a cooperative and collaborative process. Cooperation fosters learning -- "Two heads are better than one." People enjoy functioning independently but they also enjoy functioning interdependently. The interactive process appears to "scratch and nick" people's curiosity, potential, and creativity.

Cooperative approaches are enabling. Through such approaches people learn to define goals, to plan, to interact and to try group arrangements in problem solving. Paradoxically, as people invest themselves in collaborative group approaches they develop a firmer sense of their own identification. They begin to realize that they count, that they have something to give and to learn. Problems which are identified and delineated through cooperative interaction appear to challenge and to stretch people to produce creative solutions and to become more creative individuals.

Principle 5.

Learning is an evolutionary process. Behavioral change requires time and patience. Learning is not a revolutionary process. When quick changes in behavior are demanded we often resort to highly structured procedures through which we attempt to impose learning. Whether such learning is lasting and meaningful to the learner is doubtful. Implicit in all the principles and conditions for learning is an evolutionary model of learning. Learning situations characterized by free and open communication, confrontation, acceptance, respect, the right to make mistakes, self-revelation, cooperation and collaboration, ambiguity, shared evaluation, active and personal involvement, freedom from threat, and trust in the self are evolutionary in nature.

Principle 6.

Learning is sometimes a painful process. Behavioral change often calls for giving up the old and comfortable ways of believing, thinking, and valuing. It is not easy to discard familiar ways of doing things and incorporate new behavior. It is often "downright" uncomfortable to share one's self openly, to put one's ideas under the microscope of a group, and to genuinely confront other people. If growth is to occur pain is often necessary. However, the pain of breaking away from the old and the comfortable is usually followed by appreciation and pleasure in the discovery of an evolving idea or a changing self.

Principle 7.

One of the richest resources for learning is the learner himself. In a day and age when so much emphasis is being placed upon instructional media, books, and speakers as resources for learning we tend to overlook perhaps the richest resource of all -- the learner himself. Each individual has an accumulation of experiences, ideas, feelings, and attitudes which comprise a rich vein of material for problem-solving and learning. All too often this vein is barely tapped. Situations which enable people to become open to themselves, to draw upon their personal collection of data, and to share their data in cooperative interaction with others maximize learning.

Principle 8.

The process of learning is emotional as well as intellectual. Learning is affected by the total state of the individual. People are feeling beings as well as thinking beings and when their feelings and thoughts are in harmony learning is maximized. To create the optimal conditions in a group for learning to occur, people must come before purpose. Regardless of the purpose of a group it cannot be effectively accomplished when other things get in the way. If the purpose of the group is to design and carry out some task it will not be optimally achieved if people in the group are fighting and working against each other. If the purpose of the group is to discuss current issues and problems in a given field with reason and honesty then it will not be achieved if people are afraid to communicate openly.

Barriers to communication exist in people and before we can conduct "official business" we need to work with the people problems that may exist in a group. It might be said that in any group, regardless of the people problems which exist, enough group intellectual capacity remains intact for members of the group to acquire information and skills. However, to maximize the acquisition and internalization of ideas it seems reasonable that the people problems would have to be dealt with first.

Principle 9.

The processes of problem solving and learning are highly unique and individual. Each person has his own unique styles of learning and solving problems. Some personal styles of learning and problem solving are highly effective, other styles are not as effective, and still others may be ineffective. We need to assist people to define and to make explicit to themselves the approaches they ordinarily use so that they can become more effective in problem solving and learning. As people become more aware of how they learn and solve problems and become exposed to alternative models used by other people they can refine and modify their personal styles so that these can be employed more effectively.

CONDITIONS WHICH FACILITATE LEARNING

Condition 1.

Learning is facilitated in an atmosphere which encourages people to be active. The learning process thrives when there is less teacher (group leader) domination and talk and more faith that people can find alternatives and solutions satisfying to themselves. Listening to people and allowing them to use the teacher (group leader) and the group as a resource and a sounding board, facilitates the active exploration of ideas and possible solutions to problems. People are not passive and reactive receptacles into which we can pour the "right" values, the "right" answers, and the "right" ways of thinking. People are active and creative beings who need the opportunity to determine goals, issues to be discussed, and the means of evaluating themselves. They learn when they feel they are a part of what is going on -- when they are personally involved. Learning is not poured into people, learning emerges from people.

Condition 2.

Learning is facilitated in an atmosphere which promotes and facilitates the individual's discovery of the personal meaning of ideas. This means that the teacher (group leader) rather than directing or manipulating people helps them to discover the personal meaning of ideas and events for them. He creates a situation in which people are freely able to express their needs rather than having their needs dictated to them. Learning becomes an activity in which the needs of the individual and the group are considered in deciding what issues will be explored and what the subject matter will be.

No matter how permissive or unstructured a learning activity may be, there exist implicit goals in the activity itself -- a group leader (teacher) is never goalless. Learning occurs when the goals of the leader accommodate, facilitate, and encourage the individual's discovery of personal goals and personal meanings in events. The art of helping people to change their behavior requires the development of goals which provide sufficient elbow room for people to explore and internalize behavior satisfying and growth-producing to themselves.

Condition 3.

Learning is facilitated in an atmosphere which emphasizes the uniquely personal and subjective nature of learning. In such a situation, each individual has the feeling that his ideas, his feelings, his perspectives have value and significance. People need to develop an awareness that all that is to be learned is not outside or external to themselves. They develop such an awareness when they feel their own contributions and their value as people are genuinely appreciated.

Condition 4.

Learning is facilitated in an atmosphere in which difference is good and desirable. Situations which emphasize the "one right answer", the "magical solution", or the "one good way" to act or to think, or to behave, narrow and limit exploration and inhibit discovery. If people are to look at themselves, at others, and at ideas openly and reasonably, then they must have the opportunity to express their opinions no matter how different they may be. This calls for an atmosphere in which different ideas can be accepted (but not necessarily agreed with). Differences in ideas must be accepted if differences in people are to be, too.

Condition 5.

Learning is facilitated in an atmosphere which consistently recognizes people's right to make mistakes. Where mistakes are not permitted then the freedom and the willingness of people to make choices are severely limited. Growth and change are facilitated when error is accepted as a natural part of the learning process. The learning process requires the challenge of new and different experiences, the trying of the unknown, and therefore, necessarily must involve the making of mistakes. In order for people to learn they need the opportunity to explore new situations and ideas without being penalized or punished for mistakes which are integral to the activity of learning. The teacher (group leader) who feels and acts on the need to be always right creates a limiting and threatening condition to learning.

Condition 6.

Learning is facilitated in an atmosphere which tolerates ambiguity. In a rigid and defensive atmosphere people feel they cannot take the time to look at many solutions, they feel highly uncomfortable without answers, and they feel there is more concern for "right" answers rather than good answers. The open and fearless exploration of solutions calls for time to explore many alternatives and time to proceed without feeling any pressures for immediate and forthcoming answers.

Condition 7.

Learning is facilitated in an atmosphere in which evaluation is a cooperative process with emphasis on self-evaluation. If learning is a personal process, then people need the opportunity to formulate the criteria to measure their progress. Criteria established by the teacher (group leader) are mostly artificial and irrelevant to persons in a group. Usually behavioral change and growth are measured by the degree to which people can regurgitate what others have tried to spoonfeed to them. It is obvious that anyone can play the game of "giving the teacher what he wants." A more viable and meaningful evaluation occurs when people are free to examine themselves and the roles they play with other people. Self evaluation and peer evaluation enable people to really judge how much they have learned and grown, e.g., through audio and/or video taped recordings of their behavior people can see themselves in the process of learning. Such recordings provide tangible and concrete evidence of progress and provide a rich source of material to the group for learning. New insights evolve as people see themselves as they really are. For learning to occur the individual in the group needs to see himself accurately and realistically. This can be best accomplished through self and group evaluation.

Condition 8.

Learning is facilitated in an atmosphere which encourages openness of self rather than concealment of self. Problem solving and learning require that personal feelings, attitudes, ideas, questions, and concerns be openly brought to light and examined. To the degree that an idea, a thought, a feeling, or an attitude related to the topic at hand is held back and not openly expressed -- to that degree are the processes of learning and discovery inhibited. People need to feel that they can try something, fail if necessary without being humiliated, embarrassed, or diminished as persons. Openness of self occurs in an atmosphere free from psychological threat. People can invest themselves fully and openly in the collaborative and interactive process of learning when they know that no matter what they say or express it will not result in psychological punishment or penalties.

Condition 9.

Learning is facilitated in an atmosphere in which people are encouraged to trust in themselves as well as in external sources. They become less dependent upon authority when they can open up the self and when they feel that who they are is a valuable resource for learning. It is important that people feel that they have something to bring to the learning situation rather than feeling that all learning means the acquisition of facts and knowledge from some external agent for use sometime in the future. People learn when they begin to see themselves as the wellsprings of ideas and alternatives to problems. Learning is facilitated when people begin to draw ideas from themselves and others rather than relying on the teacher (group leader).

Condition 10.

Learning is facilitated in an atmosphere in which people feel they are respected. In a group in which high value is placed upon the individuality of the members and upon the relationships that exist within the group, people learn that someone cares for them. A genuine expression of care on the part of the teacher (leader) and a warm emotional climate generate an atmosphere of safety in which people can explore ideas and genuinely encounter other people without any threat. Confrontations and differences of opinion become constructive forces in a group in which people experience that they are respected as persons. A safe atmosphere need not exclude personal confrontations which often are effective catalysts for learning.

Condition 11.

Learning is facilitated in an atmosphere in which people feel they are accepted. People are free to change when they feel that change isn't being imposed upon them. It's paradoxical but the more we try to change people the more resistant they become to change. A person must be before he can become. Accepting a person means that we allow him to hold his values and to be himself. When a man does not have to defend himself or his values then he is free to take a look at himself and his values and to change. An insistence on change contains an implicit note of rejection. In effect, we say to people -- I can't accept you as you are; you must change. People need to feel they have an option -- to change or not to change. They develop this feeling when they experience that they are accepted for who they are. When people or their values are attacked it is natural that they will defend themselves. People who are busy defending themselves are not free to learn.

Condition 12.

Learning is facilitated in an atmosphere which permits confrontation. With free and open communication, with a non-threatening psychological climate, the unique self of each person is expressed. It is inevitable that in such a situation persons will confront persons, ideas will challenge ideas. Confrontations facilitate learning. They provide opportunities for people to have their ideas and themselves viewed and tested from the framework of other people or the group. No man learns in isolation from other people. His behavior changes and his ideas are refined and modified on the basis of the feedback he gets from other people. Confrontation is a proving ground which enables ideas to be synthesized, new ideas to emerge, and people to change.

CHAPTER III

Project Task 1 - Teacher Training

Trainees learn the teaching methodology by using it. First in workshops then from classrooms, teachers (and their student colleagues) plan and carry out organized watershed studies. Many training workshops begin with the teachers literally climbing into an automobile with map in hand and investigations to conduct. They travel to grid coordinates - measure stream flow, dissolved oxygen, pH, temperature, chemical content, and secure samples for bacteria and macroinvertebrate indicators to complete tests, chart data, and interpret results, they return from preliminary findings to identify an environmental problem, organize a research program and use their conclusions to propound and compare concepts. The training sequence is that which students will follow in the classroom.

The principal assumption behind this training format is that learning occurs primarily through first-hand involvement with a problem. In teacher workshops research materials, supplies, equipment and procedures are identical to those which will be used by students. Workshops serve to teach water quality analysis, distribute or make equipment, select field testing sites, plan a sampling regimen and structure relationships with adjacent school systems. Trainees participate fully in each action.

A second assumption behind reality training is that teachers will not adopt any new program unless they are personally committed. Therefore, workshops include teachers and students as staff as well as teachers and students as trainees. When staff and trainees (see Principle 4, Chapter II) "... invest themselves in group approaches ..." by planning, traveling, working, eating together, they begin to create an interdependency that later proves to be crucial in sustaining the activity. A number of factors enhance personal commitment.

One factor is the numerical proportion of workshop participants. Trainees are equal numbers of teachers and students. Logistics, tools, supplies, ideas are shared. From sharing teachers lose fear of ridicule and behave like co-discoverers. Pine and Horne noted that (Condition 1, Chapter II) "The learning process thrives when there is less teacher (group leader) domination and talk and more faith that people can find alternatives and solutions satisfying to themselves." Teacher and student trainees begin to express confidence, pride, helpfulness, and they clearly delight in the open, warm friendship that is allowed in the sharing of tasks between age groups.

Another stimulus to personal commitment is the problem-centered nature of workshops. The watershed study gives students a feeling of "doing something about the environment". The prospect of taking a major responsibility toward improving environmental quality solidifies individual commitment to the group goal. Pine and Horne write (Principle 3) "People become responsible when they have really assumed responsibility, they become independent when they have experienced independent behavior, they become able when they have experienced success ..." The group infrastructure required to conduct group research allows students to have responsibility, independence, and success.

First hand involvement and personal commitment, then, are the two primary objectives of the training workshop. For these two reasons, workshop protocol is characterized by informality, equality, friendliness, and accomplishment. In residential workshops teachers and students room separately by sex but not by age. Name tags, mixed groupings, impromptu sports, and picnics help reduce tension and engender mutual respect. Deep involvement and commitment produce a realization that pleasure and achievement can be compatible and are appropriate to an academic program.

The actual workshop practice is illustrative. At the beginning of the Project's first year, teachers and students constructed a water test kit. Together, they sawed wooden sections, assembled sides and covers, drilled holes, screwed hinges and painted "their" kits. Then they prepared and stocked each kit with chemicals, reagents and apparatus. In later workshops they wired and soldered transistorized waterbath units for bacterial incubation. One teacher cried when a second mistakenly took home "her" waterbath. They also cut aluminum bars and fine mesh cloth, bolted, stitched and assembled a Surber Sampler for macroinvertebrate collecting. By making equipment trainees learned handicraft skills, lowered program costs, interacted socially and invested personal labor which gave them the feeling of pride that accompanies "ownership".

After familiarization with equipment trainees selected test sites. Ohio Environmental Protection Agency staff first summarized each region's watershed problems. In addition the instructional staff related their investigative opportunities from studying their own communities. Then the staff directed trainees to problem areas to measure and compare water quality. Ultimately, the Ohio Environmental Protection Agency designated the locations at which they wanted biweekly data. Some trainees later requested changes depending upon transportation, the seasonal stream depth and numbers of students involved. Each site was identified by grid coordinate, assigned an Ohio EPA number and, thereafter, sampled regularly.

After two weeks the teachers left the workshop supplied with written procedures, reagents and media, flow meters, field kits and the first phase of a coordinated watershed study. There were 5 schools in Athens, Bowling Green and Dayton, 3 in Cleveland and 12 in Columbus. The Cleveland teachers were workshop staff, highly experienced from the 1972-75 "Cuyahoga River Watershed Heritage Project".

Columbus trainees were both junior and senior high school teachers; most Bowling Green and Dayton teachers were from high schools while Athens' teachers were from junior and senior high schools as well as one technical college. In addition the Athens' regional trainees were distant in economic circumstances, cultural background and physical location. These variations would determine different roles for the 5 regional Graduate Student Coordinators and eventual modifications in the Project's design.

The teachers were now ready to adopt the Project though they were not prepared to implement the Project. Through workshops they were familiar with the hands-on process and they were committed to using it during the school year. However, the teachers were not sufficiently well trained technically to instruct their students and they had not worked out an organizational plan to integrate the activities into the classroom. Further help would be necessary to clarify the students' learning objectives and the teachers' implementation objectives. Chapter IV states these objectives and Chapter V presents the strategy for reaching the objectives.

CHAPTER IV

Project Task 2 - Watershed Study Objectives

Hands-on learning could be used to study limitless subjects. The historical factors outlined in Chapter I determined that in the first year the subject of the Ohio Watershed Heritage Project would be water analysis. History, then, is the logic for the Project's objectives.

One of the most critical determinants was the "Water Quality Amendments Acts of 1972", which provided the authority and appropriations for this Project. Congress wrote and passed PL 92-500 to clean up the nation's water through construction of sewage treatment facilities, gradual curtailment of pollutants discharged into navigable waters and regional planning of water resources. Pertinent to this Project they included requirements for water quality monitoring and emphasized involvement of citizens. Congress designated the U. S. Environmental Protection Agency to enforce the Act and authorized the Agency to qualify and then subordinate legislative obligations to the 50 States. U. S. EPA's Office of Water Program Operations anticipated that trained citizens, especially teachers, could assist the States in monitoring. Simultaneously, their students would acquire education that would augment their ability to participate later in the Act's planning decisions. (Longer term implications of monitoring are suggested in the proposed rules for "Water Quality and Pollutant Source Monitoring", EPA Part III, Vol. 39, Number 168, August 28, 1974, Federal Register)

The Ohio Environmental Protection Agency was qualified by the U. S. Environmental Protection Agency and assigned PL 92-500 responsibilities before the Project started. Therefore, Ohio EPA stated what kind of water quality data were needed and which sites would be tested. The U. S. EPA National Training Center in Cincinnati assigned the analytical procedures and instructed the Institute staff. By circumstance of national need the pupil objectives for the first academic year, 1974-75, were decided.

Measurements:

1. Measure the volume of water flowing past a selected point and express as cubic feet per second.
2. Determine the amount of dissolved oxygen present in the water at that point in milligrams per liter.
3. Calculate the number of fecal coliform colonies present in 100 milliliters of water.
4. Express the relative amount of acidity or alkalinity in pH units.
5. Record the water temperature in degrees centigrade.

Conditions:

1. For flow use the Pygmy Teledyne-Gurley flow meter, immersed at depths and stream bank distances as specified in U. S. Geological Survey methods.
2. Determine dissolved oxygen by a modified alkali-azide Winkler method, fixing oxygen in the field with preweighed reagents and titrating in the laboratory with sodium thiosulfate.
3. Count fecal coliform after membrane filtration of the water sample culture on appropriate median and incubation at 44.5°C ± 0.2°C for 24 hours.
4. Measure the acidity by standardized pH Meter.
5. Water temperature requires a standardized centigrade thermometer.

Extent:

1. Take flow measurements and all other tests or water samples at the same location, identified by grid coordinates and stream bank markings.
2. Average results from three determinations for dissolved oxygen, fecal coliform, pH and temperature.
3. Measure all parameters at two week intervals throughout the school year.

The aim of each objective is to teach professionally recognized water quality procedures. Therefore, the origin and reference for each test is Standard Methods for the Examination of Water and Wastewater, 13th edition, published by the American Public Health Association, 1015 Eighteenth Street, NW, Washington, D. C. 20036. The Institute elaborated the procedure in Volumes I and II of the Guide Series (listed on the inside front cover) and produced audio-visual learning units for dissolved oxygen and fecal coliform methods. Procedure limitations, techniques and supplementary tests are included or cross-referenced in Institute publications. Additions to these few objectives have been made and will be described in later reports - see Chapter XII for Project dissemination plans.

Following summer training, described in Chapter III, and with equipment, supplies and student objectives in hand, teachers began implementation. School administrators had previously sanctioned adoption of the Project but they had not required teachers to state explicit plans for implementation. Also, the Institute's summer staff assumed that articulation of, and preparation for, introducing new processes and materials were either unnecessary or fruitless at that point in time. They relied instead upon the inservice year's regional program to assist the teachers. The regional program is presented in Chapter V. (Additional information about attempts to implement changes in school systems generally is condensed in Chapter XIII.)

The teachers' implementation objectives would become the central concern of regional monthly meetings throughout the entire school year. Fully detailed in another publication (Volume VI - see inside front cover) these are the major responsibilities which each teacher would face:

- assign investigative activities appropriately by grade level, class number and daily schedule;
- specify the extent of pupil involvement - include frequency of sampling, time needed, supply costs;
- negotiate transportation schedule, off-campus permission, safety precautions, community impact, extracurricular conflicts to the limiting factors;
- use field data to propose concepts; use other resources to interpret and extend the study;
- relate to other teachers and their courses within, and between, schools;
- develop complementary skills, such as interviewing, photography, report writing, public speaking;
- organize the field and classroom sequence so that it is purposeful, challenging and achievable.

CHAPTER V

Project Task 3 - A Sustaining Mechanism

The earliest efforts to apply the teaching methodology through watershed studies proved that summer training alone could not guarantee implementation. Teachers needed support but found it lacking within the established school system. They would require an extracurricular structure similar to that which accommodates the football team and a coach, a game plan and playing schedule as well. Out of necessity the Institute helped create a mechanism external to the school curriculum which provided an "educational coach", "player contracts" and performance deadlines.

The mechanism is an operational relationship among a state university, surrounding secondary schools and an environmental regulatory agency. The idea for this relationship originated in 1971 before the newly incorporated Institute for Environmental Education accepted federal grants to start the Northeast Ohio three-year experiment, the "Cuyahoga River Watershed Project". Dr. Robert Rolan, Director of Environmental Sciences, Institute of Urban Studies at Cleveland State University was interested in opportunities for enrolling more teachers and focusing on Cleveland's environmental problems. He was also CSU's representative to the Ohio Board of Regents Inter-university Committee on Environmental Quality. Under Dr. Rolan the Institute's Dr. Peter Gail established inservice courses for Cuyahoga Project member teachers and three years later Dr. Rolan described this operation to the Regents Committee. Four of the eleven member state universities (selected for their geographic location and limited in number by grant funds) subsequently became, with CSU, the "educational coaches" for the five regions which, in 1974, formed the "Ohio Watershed Heritage Project".

During the"Cuyahoga River Watershed Project's" three year history, the Institute and Northeast Ohio schools worked with a number of regulatory and civic organizations, seeking to create a suitable education:service agreement. Several, however, such as the City of Cleveland Environmental Health Service and the Federal Trade Commission were contacted before sufficient organization and training were available to plan and carry out responsible field investigations. But, by 1974, the State University and the schools were synchronized and the requirements of the U. S. Environmental Protection Agency's PL 92-500 were an opportunity.

The Ohio EPA chose from the Regent's Committee members four state universities for their proximity to Ohio EPA District Offices: in Athens - Ohio University; Bowling Green - Bowling Green State University; Cleveland - Cleveland State University; Columbus - Ohio State University; and in Dayton - Wright State University. As soon as the universities were identified the Institute commenced three-way negotiations among university, the Ohio EPA and secondary schools.

First, the Institute contacted university professors identified by their academic responsibility for environmental education. These were:

Athens:	Dr. John Collier Dr. Ray Skinner	(Matt Ginsberg)
Bowling Green:	Dr. William Jackson	(Guy Acerra)
Cleveland:	Dr. Paul Olynyk	(Tom McKenney)
Columbus:	Dr. John Disinger Dr. Robert Roth	(Jane Adams)
Dayton:	Dr. Ronald Schmidt Dr. Michael Smith	(Beverly Warner)

These men were as interested as Dr. Rolan had been three years earlier in seeking closer community programming with secondary schools. They agreed to these actual contractual obligations:

(1) "Identify a graduate student capable of coordinating the high school program, recognize his/her work with the student as a course for credit activity, and provide appropriate faculty supervision of the student.

(2) "Provide lab facilities for the two-week summer training program (July 8-19, 1974) and grant credit to the teachers attending the course.

(3) "Assist in the development of the program and participate in evaluation of the program and ways to improve its effectiveness.

(4) "Develop the liaison with local high school administrators, teachers, and students.

(5) "Operate in accord with the plan proposed to U. S. EPA and funded on April 4, 1974."

Professors in the four new regions began fulfilling the contract terms in April and May 1974. They recruited a graduate student offering him U. S. EPA and private foundation grant funds, $500 to work with the Institute's training staff, a $3500 Fellowship to coordinate the regional schools September 1974 - June 1975 and $1500 for travel, communications, supplies and the university's administrative overhead. The graduate students chosen are listed in parentheses above. Each professor also contacted five local secondary schools often through administrators or teachers who had been their students. The prospective Project teachers were screened a priori for interest and competence. Next, each of these teachers selected one student (occasionally two) to be a training partner. By June three regions secured five schools with two teacher:student teams from each school - except in Columbus where zealous Dr. John Disinger signed on 13 schools. (Later, this larger number would become a handicap for the coordinating graduate student.) The Project officially commenced in mid-June 1974.

At that date the regional graduate students attended a two-week Project orientation and technical seminar in Cleveland. Immediately after they returned to their regions and, one week later, with help from Institute staff they duplicated the two-week sessions with their regions' teacher:student teams. The training details are in Chapter III. By the end of the summer Project participants from the universities, Ohio EPA Central and District Offices and the schools had worked together, understood the plan and were prepared to coordinate their activities systematically during the academic year.

A major function of the compact was facilitating information exchange. The information of first importance concerned startup progress and problems between teachers and students, teachers and administrators and the distribution of technical equipment. The information exchanges were mostly in person. There were four types of meetings: (1) graduate students and teachers weekly or biweekly; (2) graduate students, their professors, other resource persons, teachers and their students monthly; (3) IEE staff periodically in person but also through letters, telephone calls and supply shipments; and (4) all participated during a 2-day workshop in April 1975.

The information exchanged related to the summer's technical training and its application under school circumstances. Discussions included the use of equipment, standardization of chemicals, quality control, etc., as well as the processing of collected data, its interpretation, and the use to which the reports would be put by the Ohio EPA. As often as the meetings centered about technical aspects, they also concentrated on problems of transportation, availability of supplies and equipment and particularly operational responsibilities. Of the three major areas of responsibility, the best understood was that of the teachers and students, next the university professor and his graduate student and the least was that of the Ohio EPA District Office's personnel.

The schools were junior and senior high (in one area a 2-year technical college), private, parochial, and public, all boys, all girls, co-educational, urban, suburban, rural, wealthy, poor, and diversely and deeply committed to the Project. In some schools the Project students were a small number of high achievers, in others an entire class of mixed ability students and in at least one they were small numbers of very low achievers. Interest, ability and energy seemed to cut across all of the above categories and these were the most important student determinants for success.

The Project school task was to collect specified water quality data from assigned streams and at scheduled times. The data was to be reported on a standard form, identified by grid coordinates and station site computer code number and submitted biweekly to the nearby Ohio EPA District Office. Summer, and then inservice year teacher training, provided all necessary information to start this program although later funding shortages restricted the numbers of costly equipment and, in turn, the amount of accurate information produced. Beyond these Project assignments many schools proceeded to make other field measurements and to use that information to broaden the program.

The university in the four new regions functioned in the same capacity as the Institute for Environmental Education in Cleveland for the 30-school "Cuyahoga River Watershed Project". The university serves as regional Project Coordinator. The professor has knowledge of the schools, university administration and can help establish course credit. The graduate student handles all off-campus contacts. The professor signed the contract, chose the graduate student, recruited schools, hosted the two-week summer training program and then attended monthly meetings, instructed at seminars and supervised the graduate student.

The graduate student's role varied considerably from one region to another - a teacher's field assistant in one, an equipment deliveryboy in another. The graduate students delivered sensitive and costly equipment (a Teledyne-Gurley Pygmy Flowmeter, a Yellow Springs Instrument Company Dissolved Oxygen Meter, a pH Meter) to each school as tests were scheduled. They also prepared, delivered, and checked short-lived chemical reagents and assisted teachers and students in field and laboratory procedures and in contacting community resources to augment classroom interpretation. Some Coordinators became personally very intimate with teachers and students, others did not even have the time to fulfill more than the simplest functions. All Coordinators were superbly qualified in some technical competence, professional interest in education and readiness to do more than the job first required. They were highly regarded by teachers and students, the latter even remarking that"somebody cares!" For the reasons detailed later in this report it became evident that a single graduate, with 15 hours per week available, is extended unfairly to the Project if he is assigned more than five schools to coordinate.

The Ohio EPA planned that, in addition to granting equipment funds, the District Offices would each have one designated staff member who would participate regularly in the Project. That staff member would receive the data, forward for storage in the national STORET system and receive back an indication from the central Ohio EPA Office how that data was used to effect further investigations or decisions. The District Officer would then tell the schools what further frequencies, sites, or new data might be needed. Even though each Region progressed at different rates, all of the actions did not take place.

The data pipeline was "valved" between field and central Ohio EPA, next the teacher, the graduate student and his professor and then the District Office. During the course of the first year, data was held in each Region by any one of these determination points. In the first situation, the students did not have sufficient equipment; in the second the teacher might not have been satisfied with the quality; in the third the professor sometimes wished to see information from all of the schools simultaneously; and, in the last, often the District Officer could not be contacted or he postponed forwarding the data for reasons not always understood. The reasons included his need to have information over a longer time span, insufficient time to record and enter the data, lack of Project knowledge due to personnel reassignments and still-continuing preoccupation with consequences of November 1974 election turnabouts and subsequent budget changes. Agency coordination among the five District Offices was the Project's weakest link and correction provided an important development to the Project's second year (described in a later Chapter).

Further role description is contained in Chapters VIII-XI from taped interviews and written responses of graduate students, teachers, students, parents, and non-Project participants. These remarks characterize the experiences of the first year more than they define the future role. Funds for a professional assessment are currently being sought. Further reports will then become available during 1977.

CHAPTER VI

Evaluation

An evaluation instrument was designed to produce comparative information about Project implementation and to catalogue both planned and unplanned outcomes. Data was collected differentially by Region, by school and by information source. The instrument proved a useful measure of achievement and harvested a diversity of value judgements. Decisions considering the results modified the second year's summer training and organizational relationships among the three principal groups and the substance of student activities.

The primary evaluation instrument was a questionnaire. It contained ten information and five source categories. The matrix outline follows and a copy of the questionnaire is appended:

Information Category		Source Category				
		Grad Stu	Teachers	Students	Parents	Observers
I.	Before the Project	X	X	X	-	-
II.	Changes subsequently	X	X	X	-	X
III.	Program definition and features	X	X	X	-	-
IV.	Benefits to students	X	-	X	X	X
V.	Multiple discipline approaches	X	X	-	-	-
VI.	Relevance of topic	X	X	X	-	-
VII.	Outside perception of the program	X	-	X	-	-
VIII.	Ways of evaluating the program	-	X	X	-	-
IX.	Career and educational plans	-	X	X	X	-
X.	Self learning and comments	-	X	X	-	-
	Numbers of Sources responding	5	30	109	30	20

The interrogative format permitted some questions to be answered by "yes" or "no" and others by explanation. The questions were formulated by Janet Beck, a Case-Western Reserve University Law School student and field tested by Greg Cznadel, an undergraduate Project Intern from Kalamazoo College. The five Graduate Student Sources were interviewed in person and their responses taped; the remaining Sources responded in writing. The period of administration was May-June, 1975, nearly a full school year after initiation.

A second questionnaire was answered by students attending a teacher:student feedback session April 11-12, 1975. Five questions authored by the U. S. Environmental Protection Agency were given to forty-five students. The questions were:

1. Is the Project challenging to you? Why?
2. How do you feel about it personally?
3. What have you learned?
4. What is your future in the Project?
5. What would make the Project better?

Responses were listed by Region and school, copied and distributed to each of the five Regional Coordinators for teacher information. Additional copies were sent to U. S. EPA and Ohio EPA (and are available from IEE).

Other evaluation information came from non-formal mechanisms. Monthly regional meetings, telephone conversations, letters, school site visits - all provided opportunities to ask questions of teachers and students, observe field sampling procedures and examine equipment and reports on a personal level.

Collectively, formal and non-formal channels provided the background for this report. Selected data is presented by Source from the first and second questionnaires in the following Chapters. They present this overall picture:

Regions - four out of five successfully implemented the Project

Graduate Student Coordinators - popular, respected, effectively employed in small regions, relegated to delivery status in large region

Teachers - elated with student achievement and administration and parent support; frustrated by equipment shortage, inadequate supplies and field logistics

Students - challenged by national environmental priority, enriched by research experience, pleased with teacher:student equity, bored when limited to test repetition, disappointed when EPA not involved, begged activity expansions

Parents - gratified by school's adoption, recognized career implications, accepted risks, reported heightened interest in learning, helped with transportation

Observers - emphasized practical value, lauded student cognizance of environmental problems, associated value to independent learning and community improvement

At a later stage the Project should be evaluated professionally by an outside organization. Plans have been formed with Case-Western Reserve University to research an evaluation procedure and to conduct the study. Findings will relate to why schools first "adopt" the Project and, then, to how teachers and students "implement" the Project. The evaluation will include verification of student performance examinations and will itemize recommendations for Project improvement. Its purpose will be to guide teachers toward effective, economical adaptation of investigative processes generally and environmental studies particularly.

CHAPTER VII

The Graduate Students

As information sources, Graduate Students Coordinators are uniquely qualified to report regional Project activity. In 1975 they were chosen by University faculty for motivation and ability and then they were paid through grants from the Institute for Environmental Education to communicate critically and regularly with all participating regional teachers and students throughout the school year. The Institute's assessment was that their integrity and honesty was unassailable.

Not all Coordinators, however, had equal access to information. One covered three schools, another thirteen. Some became intimate associates with the teachers and students, a few were seen as teachers' assistants and given field responsibilities by these teachers, others had time only to transport equipment or supplies, one started in mid-year and each had different teacher needs to manage individually. Information opportunities, therefore, were a function of several factors which is restated in Student statements.

For these reasons responses to questions (see Appendix) are quoted directly. Between March and April 1975 three Graduates were interviewed in person and the conversation recorded, two replied in writing. The former procedure offered some new directions which justified occasional departure from the prepared series and the latter produced variously long, short or no answers to the questions. Excerpts are given beneath the most appropriate question and, if and when answered, from each Student in rotation:

Matt Ginsburg	Athens	Ohio University
Guy Acerra	Bowling Green	Bowling Green University
Tom McKenney	Cleveland	Cleveland State University
Jane Adams	Columbus	Ohio State University
Bev Warner	Dayton	Wright State University

Question IA - What is your role?

(Matt Ginsburg began his master's in Biology during the Project's first year. He inherited a most difficult situation and throughout the year received the least help. Some of the schools are still participating but there is not a funded Coordinator at Ohio University in the second year.)

From day one, when the summer laboratory at Ohio University was locked, unstaffed and unequipped, improbable imbroglios consumed time and energies. As mentioned in Chapter III the participating schools ranged as far north as Lancaster, Ohio (near Columbus), from junior to senior high to a two-year technical college, from well-financed Lancaster Public Schools to virtually impoverished Federal Hocking Junior High School. Individually the teachers were culturally polarized, differed widely in academic preparation and expected either an extremely structured course, with elaborate support or simply words of encouragement. Confusion and antagonisms more than learning and commitment characterized the summer training meetings to the extent that the Graduate Student devoted his follow-up time to reconstruction rather than coordination.

(Guy Acerra, at the time of interview, was a master's candidate at Bowling Green University. Upon completion of requirements in August 1975 he matriculated at Ohio State University's doctoral program and continues with the Project, succeeding Jane Adams.)

> In terms of what I do, if the Graduate Student weren't there, the program wouldn't be in existence....to tie in all the high schools. It's really hard for the high schools to get out on their own and make it meaningful. I think someone should be there coordinating the effort. In our case we have high schools 25-30 miles apart and they are working together pretty well. My role is to tie in all their work and make it seem like they're working as a whole instead of just little pieces. The main thing....you know people oftentimes, when they are working, thinking about the environment, consider themselves powerless and maybe even a school can get that same idea. They think, 'Well, if I do something it's not going to mean anything. If my school does something, it's not going to mean anything.' I think the Graduate Student can tie all the schools together and the Graduate Students' role is very important since there are schools in various parts of the State. There is a

> Graduate Student in Columbus, and Dayton, and Athens ... and we're all working toward the same thing and you don't have the feeling that my work doesn't count. It does count and you can see it. And I think the students can tell. I can tell it and if I can keep the students aware then it will be a lot better when someone's out testing Po Ditch every other Thursday. They test it and they get a little bit out of it but this way there's a whole they're working towards. I think that's one of the things that should really be brought out. My role is to keep that whole going.
>
> In Columbus there are 13 schools, here there are only four. That makes it easier for me; I can spend a lot of time with them and get out into the field. They ask me questions and I try to answer them as best I can. They need resources and I try to lead them to resources.

(Tom McKenney became the Cleveland Graduate Student in January 1975, mid-way through the year. The teachers in his schools were among the most experienced of the three-year old thirty-school "Cuyahoga Heritage Project" in Northeast Ohio and had served as Project staff during the summer training.)

> My role is surely a bit different than what it was originally intended and different from the other Graduates. This is due to the fact that I came in late and my three teachers were all pretty much independently doing the Project. My main role was to get the three schools together, to make sure they were all using the same methods, to coordinate sharing equipment and coordinate the data. I also feel a great role is providing additional learning experiences for the student. For example, we visited the State Laboratories and we talked about other parameters of testing while doing our bi-weekly testing.

(Jane Adams is a master's candidate in Ohio State University's School of Natural Resources. Unlike Guy with four schools, Jane coordinated thirteen junior and senior high schools in and around Columbus. She saw her role, disappointingly, as a supply courier.)

> In the beginning it took a little bit of administrative talent to pull things together so that was challenging. Now I've got everything pulled together so the only questions that come up are hassle-type questions like the flow-meter going out ... aggravating kinds of things. I just drive out to the schools, deliver the stuff and I'm not teaching like I would like. That's the main thing, my position as a Graduate Student is not what I would like it to be.

(Beverly Jean Warner, Masters of Science program in Analytical Chemistry at Wright State University, researching acid mine drainage water conditions, coordinated five schools. Some of her teachers felt they didn't need a coordinator and in the second year there is not a full-time substitute for Bev.)

Like the other Coordinators, Bev found that some teachers depended upon her to conduct student field investigations, others were self provident after the summer orientation. Typically, she prepared chemical reagents for the teachers and delivered the single set of costly equipment to each school in succession. Ultimately, these delivery duties would be eliminated as the schools acquired their own equipment or mixed or purchased the required consumable supplies.

For the second year scholarship funds have not been generated for Bev's successor. The Acting Director of Wright State's Environmental Center is seeking four-year Project scholarships from local industries and private foundations with the assumption that if the Graduate Student Coordinator is needed by additional participating schools they will support that cost through tuition or fees. The regional teachers are now functioning without regular University assistance.

Question 1B-How does this function differ from other jobs you have had as a teacher, scientist, coordinator, etc.?

Matt: I've never had a job like this before.
Guy: Well, actually it doesn't differ very much at all. My interests, you know have been in geography and geology for awhile. I've always had these interests. I've been steering off, like this map work with the blind. But it's like night and day. Mostly I keep coming back to this and I've decided this is what I'll be doing.
Tom: The main difference between this function and others I have had are that this is far less structured. I was on my own more so than in many other jobs. This allowed me to be creative.
Bev: This differs greatly as I act more as a 'third party' rather than being intimately involved in part of the program.

Question II-Has this work changed any of your career or educational goals? In what wa

Matt: No.
Guy: It certainly has. You know I'm really going to be involved with this program next year. A year ago I really didn't see it. I thought of myself as going into strict research for the blind and there've been a lot of things coming up that are making me move to environmental education. I think it's a good move.
Tom: Yes. It affirmed my knowledge about myself that I will never be any good for a highly structured, boring, 9-5 type job. I have a renewed interest in teaching as a career.
Jane: I'm sure that if I were to go into curriculum design this is a good, practical experience, the problems you run into in a pilot program, definitely it's a valuable experience that way, knowing what little problems you run into. But it hasn't changed any goals.

Bev: No, except now I know I wouldn't teach for a living.

Question III-A-Is this Project in any way different from other courses or program you have taken, taught, or observed?

Matt: Yes.

Guy: Quite a bit. The outdoor education aspect - most things are in the classroom. I've had a field trip or two. One field trip I did have was five weeks in New England. That was the closest thing I've had to do with environmental education. Mostly we were concerned with geography and cultural things although you really work with physical and cultural data when you are water testing.

Tom: Less structured - allows more student involvement and control and student initiation of ideas or goals.

Bev: It in no way resembles any other activity I have been involved in.

Question III-B-Could you briefly compare the different approaches taken in the field and in class by the different schools you are working with?

Guy: You'd look at the schools and first examine the role of each of the teachers working at the school. First, we have a chemist working on the program, two biologists. The biologists emphasize interest in bacteria, the chemist in chemistry. And in that way they differ. The one school has quite a bit of money; that makes things go easier. The other schools have to improvise more. I think each school is getting a lot out of the different ways they approach things.

Tom: At Woodridge a core group of students do all the field work. This is done during free time in the morning. Then one or two students do one test for all five stations during their free time. Another group does another test. At Berkshire and St. Edward, the students are in five groups. Each group is responsible for the sampling and all the tests for one station. The St. Edward group must do field work after school and most do all the testing in the field and then go straight home. I feel the Woodridge method has worked the best. All the students have done all the tests at least once. However, by dividing up the tests, they get much more accurate data.

Jane: Well, one thing has to do with the open-endedness of the teachers, i.e., their philosophy as to how much responsibility to delegate to the students and how much to do themselves. I think that's kind of an interesting thing. I have one case where really everything is up to the kids and they're middle-school aged children and they have quite a bit of responsibility for making sure they have everything they need to go out into the field. They do all the calculations, fill out all the data, get it to me; it's up to them. You know, sometimes they goof, so sometimes they make it a little harder for me. But those kids are learning a lot. On the other hand I think some teachers do quite a bit themselves, quite a lot of clean-up, even taking some of the chemicals and doing tests at home. I like the concept ... getting the students to get all the data and not doing all that for them.

Bev: Two teachers use it as an after-school hours project, two do it on school time as an individual project, one does it on a class basis.

Question III-C-Are there any problems,pitfalls or obstacles common to each class involved in the Project?

Matt: The main problem I have noticed is with the students in the junior high school level. They really don't understand what they are doing and they bore easily.

Guy: (Responding to a subquestion on school scheduling) I think it should be a golden rule that field sampling has to be before 1:00 p.m. I can list a number of reasons: first of all if we go out after school we run into problems of getting people home; the people you're going to get are busy people and they have a lot of extracurricular activities, football, wrestling, etc. Your really good students would be chopped out of the program; besides they're tired. After spending all day at school you really don't want to spend more time out there. Also, if you're traveling distances like I am running into the problem of traffic jams and in the wintertime, darkness ...

Most schools split their students up so at the most they only miss one or two classes a month. Generally, the students who are with us are pretty good students. They're on the ball and missing these few hours isn't going to hurt them. I think they learn more out in the field anyhow. It tends to wake'em up especially in the wintertime!

I've had police stop in the beginning at quite a few of our sites. They said they were just checking because there were quite a few guys poaching for squirrels or the police are wondering what you are doing out there with all that funny looking stuff. I'm in an industrial area with Scott High School and I park in a truck firm and they always seem to drive by when I pull up and they always ask 'What are you doing?'. Then I explain and they say, 'Oh, that sounds good!' This one farmer lets me park on his farm and we walk down to the Portage River from there.

Tom: Most common problem is the students who forget to bring necessary equipment. They usually forget the most ordinary supplies like paper and pencil.

Jane: Very few schools here in Columbus are on flexible scheduling and so everyone here has to go out after school. I think that is a little more of a strain sometimes than where you have a more flexible scheduling and take kids out during the school day.

One school really has a nice situation. Wednesday morning is a planning time because they have a core teaching approach and so that's planning time for all teachers to get together and plan while the students go to other kinds of activities like music and art, physical education or independent study and this is when that school goes out on field studies.

One inner city school just had to drop out because it was on a very rigid system and the teacher would have to go out after school as that was his only time. And he couldn't generate enough interest among the students to devote their after school time to something like this. Many had jobs or had to go home and babysit with the kid sister and many others, I'm sure, just weren't too interested. That definitely was a detriment for them.

Flexible scheduling ... I just couldn't see teaching science any other way now.

Question III-D-What steps have been taken to modify or expand the class or field work?

Guy: Well, they are getting bored. Like Matt (a Bowling Green High School student) you met Matt earlier - I took him down to the EPA District Office so that he could learn how to test for nitrates and phosphates and that's an additional parameter. We want to add several new parameters at each of the schools. We have my computer maps (printouts of dissolved oxygen concentrations by grid coordinates) and that's an advantage the others don't have.

In Toledo, Jim (a teacher) is working on extra things over and above what we're doing. His class is going to be doing a 'time-of-travel' study on the Ottowa River. We'll sample at the headwaters and then moving downstream the same speed, we'll sample at several sites from that same parcel of water. We'll figure out what happens to bacteria over a period of time, what happens to all the parameters we test over a period of time. They're having all these different ideas now of how they're going to run this.

Tom: We have taken additional field trips. The students are also adding many more studies that build on what they are doing in the Project, i.e., road salts, acid rain, etc.

Bev: Most teachers would like to do it as a class project next year, if possible.

Question IV-A-What benefits can a teacher or student get from a program similar to this?

Matt: If there is enough interest there is much to be gained. For the teacher it's a chance to work more closely with the students. The students are learning by doing which seems about the best way.

Guy: Now the teachers have the means to explore environmental concerns which previously they may not have been able to do. There's equipment provided to them that maybe they didn't have. A lot of them didn't. There is guidance here by me, the Institute for Environmental Education, the training centers here where they learn to do things that maybe they couldn't do before. I think the teachers wanted to do things like that before; this program helps the teachers get right out and explore the community problems. Bowling Green ... every city has its problems ... Bowling Green has Po Ditch. It stinks, there's something wrong with it, the ditch, it's polluted. Okay, the students have a chance to get out there and do things with the ditch. They can get out there and see it, look at it over a period of time and find out how bad it really is. They hear stories, they can smell it. They can go right down there and test it.

Tom: It makes school more interesting for both teachers and students. It can stimulate them and renew their interest in other aspects of school.

Jane: It gives an awareness of problems in the environment, it gives them something to be exicted about, it shows them that science is useful even to the nonscience minded. Getting out of the classroom, using another format is good.

Bev: The introduction to problems of water quality and related problems through an effective monitoring program is a benefit of this program.

Question IV-B-Have teacher and student interest in this program diminished or increased during the year? Can you offer an explanation for this?

Guy: For awhile it was cyclical, depending on how things were: when we had a big problem things would kind of slow down. And then as we could work around that interest would come back up. With the first hit from winter a lot of the schools were really down. The first time we went, with Scott School, the kids just weren't prepared for cold weather and they just froze. I could just see it ..'I'm not going next week, I'm not going, I'm not going'! The kids from Whitmore were out there until it got to be 31°F, they were doing flow and the flow meter would turn and then all of a sudden it would just freeze and stop. Spring's coming up and the kids surely will want to get out and it'll be easier to test the water.

You'll always have interest because right now more kids in high school are more interested in going out and actually doing something instead of sitting in the classroom. .. matters not whether its freezing out or really hot. I've had a lot of kids in my class ask me how they can get involved but they're all senior and going to graduate.

We haven't had the problem of people dropping out. Most of the time we have someone bringing in a new student and asking if we can take him out and show him a few things. So we take another student out and we train him - the kids train him. But we really haven't had anybody drop out on us except for a couple. I think we've increased in all of the schools.

Tom: There was diminished interest at the very end. Why? Because so many other things had to be done at this time of year. But the field trips to the water resources lab helped restimulate as did the workshop April 11-12, 1975.

Jane: I don't have any real strong indication that its gone either way. It seems like more and more kids have been drawn in at our monthly meetings - each time additional students show up.

Bev: Teachers - increased. Student - in many cases - decreased as they can't see their data being used any place. (The Dayton, Ohio EPA District Office liaison staff members had been transferred and no replacement assigned to the Project.)

Matt: Diminished in general - can't really explain why.

Question VI-(Questions I-A and B answered in Chapters VIII and IX)
Do you think this program is likely to be expanded at any of the schools you are working with? Why?

(One of Guy's students): We're starting a new program, 'Senior Search', where we get out of school for 9 weeks. We work on anything we want and make a report at the end of 9 weeks. The reason for that is to work with other high schools and get us interlocked so we're closer and this program right now is doing that. In 'Senior Search' you only have to come to school one hour per week. You have an advisor, you make a report to a committee of the board members, board of education and all the big brass and they tell you whether they should give you credit or not. I was thinking about doing that with the EPA program. All seniors are eligible for it. You put your application in; the Board reviews what you're going to do; you have to write up what you're going to do, what credits you're getting. See, I'll have to drop Modern History and that English course; maybe my teacher will read my report and if she approves she'll give me the credit.

Tom: Yes, students have talked about it to other students.

Bev: Yes, the interest with the teachers is increasing greatly.

Question VII-Briefly state your opinion of the success of the program at each school.

Guy: I really like the program, I think it has a lot of merit. I really get a lot out of the program. I would like to see the students doing a little more than what they are doing now. Everybody seems to be busy all the time. The time we spend out in the field - I don't want to see it become monotonous. I think up until now we've been pretty lucky. All the kids working with the program are generally inquisitive. They try to find out things when they're out in the field. They've learned a lot. Even from where they were from last year to this year. They've learned a lot about environmental problems. Being out in the field things catch their eye or their subconscious and they pick it up a lot easier when they read about it later on. Doing things is a lot easier than reading about them and trying to learn about them that way. Doing is important. I think the program is successful in the schools that I'm involved with. No really major problems have cropped up.

Generally the students have been able to do a lot more with their education than by staying back in the classroom. There are a number of students interested in environmental careers and I think this has helped them a lot and maybe spurred their interests to try to get those environmental careers. They ask me a lot of questions about colleges and I try to refer them to colleges that specialize in environmental careers. They ask me a lot about college life in general - just to be able to give them an idea of what it's like out there ... what kind of things people study ... like what do people do when they test things ... what goes into an evaluation or a problem study ...

Tom: I think this is a tough question. Probably evaluation must be done over a period of time and it might just be an overall feeling of success or failure. Testing skills and knowledge would seem to be of only limited value for evaluation.

Jane: Yes, I think there is room for a lot more education in some cases. I don't think we've used the potential in all cases. I think we could help the teacher with curriculum ideas, teaching the significance of these parameters and what it has to do with city situations, industries, sewage treatment, politics and legislation - everything. You could just go on forever. But I think we should help them. I know some things that we could use to help them which I'm learning here at graduate school.

I think we could develop some really good curriculum packets, even interdisciplinary curriculum packets, talking about these parameters and what they mean and the social implications, what dumping sewage means and city governments. You could develop open-ended curriculum packets to give them some resources. Names of films, or people, or information - not just in science but in social science.

That would be a pretty ambitious program but that, to me, would really be an environmental education program where you really begin to tie in our environmental problems and realities and learn that they are not just science problems but more political than anything else.

Bev: Belmont - great, done as classroom project, everyone enthusiastic;
Wayne - very good, students and teacher all put in a lot of effort;
Chaminade-Julienne - great, no problems, students most dependable;
Yellow Springs - good, came in half-way through the school year, next year should be great;
Centerville - good, next year should be a lot better, teacher very enthusiastic, the few "problem students" graduate this year so they will not be returning.

The five Coordinators completed the year enthusiastically, pleased with the many successful, challenging experiences reported by teachers and students alike. One, Guy Acerra, is continuing in the Project, the other four have either completed their degree requirements or are finishing during the Project's second year. Replacement will be assigned as funding becomes available.

The Mogul Corporation in Cleveland granted Ohio State University a four-year Fellowship for a Coordinator. (Guy Acerra will be the recipient until he completes his doctoral work.) The Cleveland Foundation has awarded a grant for a Cleveland State University Fellow and Bowling Green University is supporting a Coordinator out of the Environmental Education Center's funds. Wright State University is requesting grants from Dayton area foundations and utility corporations. Only Ohio University in Athens is not actively seeking support for maintenance of the Graduate Coordinator. The procedure for shifting from grant to institutional funding for the Coordinator will remain a priority until mechanisms are resolved.

(In Oregon, the U. S. EPA has granted Fellowship funding for 1975-76, 1976-77 and, to date, the grant has been assigned to the Oregon Museum of Science and Indsutry and the two students are presently attending Portland State University.)

CHAPTER VIII

Teachers

Thirty secondary school teachers with one or two students each from 5 schools in Athens, 5 in Bowling Green, 13 in Columbus and 5 in Dayton attempted to implement the "Watershed Heritage Project" in 1974-75.

They were men and women from public and parochial schools who taught 7th-12th grades and two years of technical college. They had previously incorporated some environmental studies into their life science, general science, earth science, biology, geology, chemistry, ecology and environmental science courses. The majority reported 1-3 years of environmental teaching experience, the others from 0-10 years.

Following the two-week summer orientation to Project methodology and skills, each planned different ways to combine watershed investigations into their teaching assignments. Some adapted ideas from the Cleveland regional school teachers who had been their summer instructors: Nancy Glass from St. Edwards, Jack Arnold at Berkshire and Ron McEachen from Woodridge High Schools. These three taught environmental studies either as a complete, year-long course or as an Independent Study elective. A few considered the Project study extracurricular. Others simply used Project activities to supplement established courses. The 28 teacher trainees later made these statements about their individual implementation plans:

- I am planning to include some aspects of the program in the earth materials section of my Earth Science course,in the ecology section of my General Science course and in my assigned area of our Science Research course.
- I use it when teaching an ecology unit in General Biology and in General Science.
- It helps out a great deal in my part of the Environmental Unit dealing with water pollution.
- In chemistry - deal with water quality analyses, fits well into curriculum.
- This study has been saved for more favorable spring weather conditions for outdoor study and for a review and culmination of previous learning experiences in the areas of topographic mapping, latitude and longitude, geology and meteorology

- The overall science plan includes the study of pollution and how it affects our lives. The water quality study fits the program very well because we strive to get the students out of the building and into their community environment.

Non-uniformity in implementation may be attributable to the student-centeredness of the Project. For example, when asked how this Project differed from others, they wrote there was "much more student independence and responsibility", the "student sets goals, establishes procedures, investigates real problems", the Project was not "text book oriented, students actually performing meaningful activities and tests", and that its applicability differed by "age level, mobility, size and student interest level". Student emphasis probably accounts for the varying adaptation models.

For example, one teacher saw the Project as an Independent Study Course and so "students were very carefully selected based on ability to work independently". Another also perceived Independent Study as a suitable structure but also highly open. "My teaching methods remained basically the same; we use an individualized, independent approach. I have come to know the students better as individuals. We must leave the school atmosphere entirely. This allows the students to open up more than they do in the environmental studies which are conducted on the school lawn." A third was more egalitarian than the first; "I used this program to enrich the science background of good science students and I also used the program to encourage low-motivated students Many teachers saw pre-career relationships for all students, incentives to improve student behavior and second-level course work for older students. One summarized: "The program is a very good life-related activity. It also is good for a behavioral modification reward which has worked well, as well as a more technical study for the advanced students." In retrospect, Project teachers seem to have discovered that a process of learning which allows students to participate in firsthand experiences is not limited to subject matter, age group, geographic location or ability classification.

Implementation did seem facilitated as learning conditions approximated those described in Chapter II. Teachers noted these conditions particularly, "the students interest and the flexible schedule that we have made it very easy to incorporate the water quality program into my science program", "everyone cooperating", and "the change was made easier by the summer workshop where we got to know each other as persons." Teachers increasingly lost their fear of not knowing all the answers and found they did not have to issue complete instructions for all actions. One respondent completed her evaluation with this statement: "Change was relatively easy. I don't think you have to be a dictator to be an effective teacher."

Expectedly, the teachers did encounter difficulties - primarily insufficient equipment and transportation and, more importantly, a gradual lessening of Ohio EPA's presence. The two logistical limitations were caused because none of the several funding sources could or would provide equipment or dollars to enable each school to conduct all of the water quality tests. But, during the year, solutions appeared: schools reallocated funds from existing budgets, teachers and students raised Project money, certain tests were modified to permit use of less costly procedures and the Institute perfected or discovered accurate but less expensive equipment. Transportation was a problem in part because the Ohio EPA chose stream sites that in some cases were a considerable distance from the schools. Later many sites were changed to more accessible streams. Then, transportation was either unnecessary or parents and older students drove cars. The attrition of Ohio EPA's participation was noted keenly by teachers and especially students.

Ohio EPA committed funding for equipment and extensive manpower assistance for 1974-75. Communications from the central office to the five District Offices probably was not effective, a number of District Office staff rotated during the year and most of them were too busy with higher priorities to respond to the needs of the schools. This was not true in every region. Ohio EPA staff gave substantial, personal direction particularly in Bowling Green and Athens, to report preparation, workshop instruction and student discussions. A different relationship with the Ohio EPA is being considered for the second year's operation.

Teachers also reported some "difficulty" with school administration though that meaning was never clear. One said, "The students' cooperation made it easy, administration made it difficult." A second reported, "No credit is given to the students participating in the Project and no recognition is given to the Project as a course. The administration was approached but seemed unconcerned about the Project - only the publicity we've received." This was a surprising opinion because most administrators were extremely affirmative on occasions of media coverage, State and national recognition. Publicity emphasis may well have been the origin for the second teacher's report also. It is likely that teachers were referring not so much to personalities but to administrators as symbols of schedules, classroom availability, busing, fundings, equipment and other "hassle factors".

Most teachers were undaunted by these factors. Gains were more important than losses. They were most impressed by student achievement and the enjoyment of working on a colleague basis. The statements below suggest the depth of satisfaction discovered during the year:

- I like working with students on a more personal basis. I also find personal satisfaction in actively contributing to the environmental effort.
- Working in the close situation, and during adverse weather conditions, presents the opportunity for a teacher student relationship to develop that wouldn't be possible in the classroom.
- I find that the 'teacher' student feelings weaken and the feelings of 'co-worker' develop.
- Working with students in the field without textbook gives one a good insight as to what is important in the learning process and ones approach to evaluation.
- At the onset of this Project I really felt that keeping a group of students enthused and cooperating was almost too difficult. However, in our seemingly darkest moments several students carried the torch. The present students have a remarkable relationship.
- I enjoy working with the students outside and am able to reciprocate their enthusiasm more readily.
- I am capable of treating students as equals and students are capable of shouldering more responsibility than I sometimes give them credit for.
- I enjoy teaching more when the student is enjoying learning.

These statements did not include the fact that in spite of the benefits the program was physically demanding. But, this factor too, was largely ignored. Only one broached the burden directly, stating, "I was already doing all the activities which I am physically capable of doing. This program hurts the quality of my teaching in classes." An extra physical exertion is needed to create the structure and goals so that the program can generate the results listed above. Motivation for that effort comes from frequent reenforcing interaction with other teachers, the University Graduate Student Coordinator and the environmental agency.

(In the Athens Region, that external support system collapsed around the teachers - for reasons given in the previous Chapter. A few teachers, especially at Logan and Hocking Technical College doggedly tested water throughout the year but neither school permanently incorporated the Project in the second year.)

The teachers rated the program by looking at changes in students' attitudes and compared student-originated goals with achievement through interviews, written examinations and laboratory work. Some perceived greater student self-reliance and initiative and ranked these gains positively. The words expressing heightened "interest", "achievement", and "enthusiasm" were mentioned as often as quantitative gains. In the end they discovered ways to increase the Project's effectiveness and made these recommendations:

To the Institute:

1. locate stream test sites nearer schools;
2. locate more, better and less expensive equipment;
3. increase availability of premeasured supplies;
4. add new test parameters;
5. put more emphasis on data interpretation;
6. keep administrators informed;
7. organize into independent study modules.

To the Schools:

1. involve more students;
2. schedule longer blocks of school time;
3. secure regular transportation;
4. assign reserved classroom space for Project work;
5. establish a two-year program sequence;
6. change from extracurricular to entirely curricular program.

The Institute has considered and acted upon the first seven recommendations. The 1975 summer and inservice year training are organized to achieve these new goals. Completion of the independent study modules will help the schools gain recognition of the Project as a legitimate course. Thereafter, the schools' first four recommendations should be met.

CHAPTER IX

Students

As a student in environmental science class I think the class is more than just a classroom and a grade. This class gives us the opportunity to go out in the field and discover, research and report what we are finding. While learning about out environment we also can help solve some of these problems that our society is faced with. Because this is our society and our environment we should have a part in doing something about it. We polluted it, let's help clean it up because we are going to live here for a long time. And, if we don't get involved like this then why should we or anyone else be griping how bad everything is - if we don't try to do something about it.

We help ourselves through this course and our studies. We help other people take care of their pollutants because they're too busy. This work we do is all free and we are helping EPA to clean up our environment. All we get out of it is a grade and a lot of fun. But, most of all, a satisfaction of knowing we tried to do something about it.

'A student's view on Environmental Science
Dennis McMahan, 12th grade
St. Edwards High School

The other Project students agreed with Dennis McMahan. Sixty four students responding to questionnaires were overwhelmingly affirmative and urged that the program be expanded. They wanted more students included and more equipment, additional water testing techniques and data interpretation and, emphatically, continued involvement of the Ohio EPA. They most urgently wanted to continue the purposefulness of their labors and the new-found relationships with fellow students and teachers.

Corresponding with length of participation, students discovered values which they had not anticipated. These values would be important to Project expansion. An analysis of 50 written questionnaires reveals this ranking of reasons for originally electing the Project:

38% - environment or environmental problems specifically mentioned
30% - interesting, fun, curiosity, challenging, worthwhile
10% - I love the out-of-doors, nature, the woods, walking up streams
10% - science orientation, a good way to start science
6% - science teacher's recommendation
2% - job implications
2% - self-learning
2% - something to do during the summer.

After several months' involvement, students recognized two new groups of reasons why they liked the Project. The reordered the original reasons slightly but placed the new groups in first and second place:

1. freedom, responsibility, relevance, firsthand experience;
2. people-people orientation;
3. environmental content;
4. applied science;
5. advance preparation for later courses and careers;
6. knowledge for self-improvement;
7. getting outdoors.

Throughout all forms of communication, the students expressed surprise and delight by (1) the recognition given to their usefulness and (2) the high regard from their colleagues.

Attempting to account for these categorizations, the students described differences between other courses and Project activities. Most students mentioned that their teachers did not issue texts and did not lecture. Instead, teachers used slides and references and determined assignments in group discussion. The students confirmed that decision-making involved everyone and that the discussions were usually essential and informative. They added, however, this unfamiliar procedure caused some confusion. Sixty-six percent of the students rated planning from "well organized to pretty much organized", while the rest thought it was clearly not well organized - at least in the beginning. They were generous in acknowledging startup problems, but at least 80% encouraged better organization in the future. A major difference was that facts were obtained first-hand at an outdoor location. The amount of time outside varied from a few minutes to ten hours; all students averaged 40% of the Project time outdoors. The subject matter was interesting and challenging to all but one student who thought it was too easy. Later they would insist on learning new techniques and environmental relationships. Their direct words are more illustrative of the Project's differences.

Freedom, responsibility, relevance, firsthand experience

These words were used repeatedly, often together, sometimes separately, never to mean escape from classroom or work but always to grope toward a statement of mission. The students become aware of a logic between now and school and the future and out-of-schoo Awareness of a connection seems to precede statements of purpose, being needed and identification with a role. Though apparent in later statements following, these observations are illustrated in the five quotations selected and arranged below:

- I've definitely learned the technical skills, that's practically a basic requirement by now. Apart from that, I've begun to see how many factors are related in the environment (such as cause-effect of stream damage). I've also seen the attitudes that most people have toward the environment and studies like this.

- I have learned, of course, how to take flow, D.O., total coliform and pH. I have also picked up five easy steps to falling into water. Also, you become aware of your father's 25 years in the power industry gut reaction to the EPA. What we're up against is stifling. He will admit things are bad but what can you do about it, stop running all the industries? Where is the money to clean up going to come from? Probably the biggest advantage of this program is getting a head start on thinking about what to do.

- I like this approach. It gives you more freedom and responsibility.

- Learning from experiences, class seems much more relevant to what's going on in the world and what I can do about it.

- There are all kinds of things you could work into it. Anything from the macroinvetebrates to the songs of the birds along the shore. I only wish we had a period or two a week during school to give myself and others some time to devise some new and different techniques and investigations. Not only would it benefit the EPA but it would also supply some good experience and possible topics for extensive investigations.

People-to-people orientation

"Teachers" are stereotypes. Students were surprised when the teachers broke out of the stereotype. Later, their fellow students and beyond them community persons, also turned out to be "people". Students liked what they found and became almost possessive about the events which opened doors between them and their colleagues. The wonder is direct and simple:

- You really get to know your teachers as people.
- When I first started, I didn't realize that teachers are people. But now when I see a teacher, I think about the person. In this way I am glad I took the course.
- There is a definite bond of friendship between students, teacher.
- Everyone in our group gets along well and it adds to the enjoyment.
- I don't feel that this Project puts us so much in competition.
- I learned that I was really wrong in thinking that this course was for special people.
- This type of course is a first for me. I really like it. Mrs. Glass has removed the pressure but not the desire for learning. It has become less mechanical and more natural. She has a way of teaching so that what you learn becomes a useful part of your life; not just 40 minutes a day out of your life like some classes have been.
- This course was the most interesting I have ever had and I hope they keep it in the high schools for a long time. All you need is student interest and a motivation and it should be a great course. You also need a teacher like the one we have at Whitmer who always helps anybody with questions

> whether he is busy or not. The last thing is a graduate student like the one we have (had?, he's leaving us) in Northwest Ohio (Bowling Green District). Our graduate student taught us a great deal about water pollution as well as many other environmental things and that's what you need - a Guy Acerra!!! always asking a question to make you think.

Environmental Content

Students have lost interest in environmental issues primarily because they have not had access to their causes. The Project places them in a position to understand the nature of environmental problems. With the acquisition of certain skills and knowledge, students can handle decisions and tasks typically reserved for much older persons. In short, the commitment to environmental improvement is there, the lack of channeling is a frustration. The Project is one channel and the students reflect the satisfaction it provides:

- I think it's great that people our age can do something about the environm
- I find it extremely interesting because I feel that I am doing something ab water quality and the environment. In the long run I think (I hope) our data will be used to improve water quality and, hopefully, will save many natural bodies of water.
- I know quite a bit more about water pollution and it gets me interested in cleaning up water and also the pollution everywhere. I like to help the environment in any way I can.
- Now when I look at samples of water I can say more than that it just looks clean or dirty. I can take tests to find out the condition of the water and also the factors that affect it.
- First, I've acquired the technical skills concerning water testing; second it has increased my awareness of problems related to protecting the environment and also of how wide-spread pollution is in the environment.
- I think this Project is challenging because it involves fields of study that I've never come in contact with before. It also goes beyond just technical work, it involves a lot of thinking, interpreting data.
- I'm a senior this year but I would like, and am going, to continue going out to test with our school. I'm going to help teach the new students everything I learned during this year. I'm very interested in environmental problems and would like a job having to do with what we are doing but I don't really want to go to college. So, if I can find a job of this type that is what my career will be.
- Personally, I really enjoy the Project. I think I like water-testing more than any other school-related activity (extracurricular or otherwise). I like meeting and working with new people; I enjoy running the chemical tests and I nourish the idea that what I'm doing is helping out in some way.

Applied Science

Students stated that the Project allowed opportunities for applying science as distinc from applying science to environmental problems:

- It's a somewhat 'open' class in which you can ask questions. You can learn procedure in the classroom, try it with tap water in the lab and do it for real in the field.
- That things are of a hands-on treatment so that you can learn things as well as look at the materials and realize what and how they are made.
- Actually doing the tests and tabulations, thus being able to see the results.
- The knowledge of new equipment and tests, characteristics of our stream water and to include ideas of data processed from other schools.
- I personally think it is a great learning experience and I hope it continues in the schools. Everyone in our group likes more about these issues and applying our knowledge in the field.
- I have two more years in high school and as long as the Project is kept up I will be involved. I really enjoy going out in the field and making observations and then coming back to the lab and analyzing the data. I can hardly wait until summer when I will have more time to work out some new projects for our area program.

Advance preparation for later courses and careers

Junior and senior high school pupils were equally cognizant of academic advantages from early preparation:

- (A 7th grader) It's a good way to learn chemistry before you're in high school.
- My lab skills are more advanced than others in my class.
- I'm probably more adequate in the lab and have developed more proficient methods of chemical testing.
- I know a great deal more about lab equipment and chemistry.
- I think there is a lot of biology and chemistry to be picked up at these workshops. My biology class in school is really easy this year. I recalled experiences from earlier workshops. Also I like to meet different people.
- Prepares for college due to the fact that one works on his own and is not pressured.
- (A 12th grader) Unfortunately, after this summer, I will not be able to stay in the Project but the Project interested me in the protection of the environment so I am planning on majoring in mining engineering with an environmental background at Penn State.
- It enables a person to work out real life problems as he would once he gets out of school.
- I feel that the EPA is interesting and fun and offers a lifetime of challenging experiences.

Knowledge for self-improvement

The students also sensed that they were gaining some knowledge which would benefit them generally, particularly knowledge about learning. The impact is advocacy for the process:

- I can do what I want and know I can do it.
- I have learned to be more precise.
- I like to teach people things. I can organize people if I myself know what I'm doing. I'm not a detail worker.
- I have learned that I could never get a job sitting at a desk all day long and this course helped me from being so shy because we met so many people it was hard not to be friends with every one of them.

- That I should get involved in activities, they make things interesting.
- I learned I will have to get things done early and not wait until the last minute.
- You do some of the actual work, working with the teacher helps you learn.
- I think the Project is challenging and very interesting. I have learned more about water pollution and the environment than I ever knew and I pass what I learn from this to family and friends. I like the Statewide and other kinds of meetings we go to and I hope there are more meetings.
- I've learned that a project like improving water quality would take a long time and a great deal of work. Just gathering data and determining quality at the present time takes an extreme amount of work and time. I've learned that there are many elements involved in water quality and that there are many variables that will change that quality.
- I've learned how to test for D.O., test for pH, fecal strep, flow, bottom samples; we've put hester-dendys in our rivers, all this plus more in the science field. You also learn about people. People from all over the State, their problems with their communities and, basically, that we're all alike, even though we have different ideas and come from different parts of the State.

Getting Outdoors

There is no doubting the attractiveness of leaving the classroom for the out-of-doors. Occasionally winter's physical discomfort, plus the freezing of instruments, hampered data collection. The loss of information was in part compensated by the gain to group solidarity which resulted from sharing a hardship. Appropriate clothing and care in selecting only wadeable streams are concerns worth mentioning again:

- You have to be in the cold and learn everything about it.
- I thought it was good to be able to help out with the environment and I enjoyed it (except falling in the water on cold days).
- It is a good experience to get away from the city, to the country. You get to meet new and different people that you would never have the chance to meet otherwise. I can really relate and get into it.
- I like the people and going to the river to do experiments rather than in the lab.
- After being in school four periods, it gives me a rest.
- I like it. It gives you a chance to participate. It beats classroom work.
- (Eight students used these words.) That it is outside and doesn't have the school room atmosphere.

* * *

The student opinions presented above might be useful in constructing an evaluation devi They reported that one half received grades based on written examination; the other hal on field and laboratory performance. Most felt they should be judged on the basis of (1) their interest level, (2) contribution to group tasks, (3) ability to perform analyses, (4) techniques in equipment usage, and (5) success in teaching others how to perform the same investigation.

No hard data was obtained on how well the Project students performed vis a vis their other courses. Twenty eight percent estimated that their grades had improved, sixty eight percent believed they had remained pretty much the same (though many of these said, "I can't do any better than an A"). The final four percent wrote that their grades were down. In contrast to the students' estimation of four percent lower grades, only one teacher said students' grades had dropped. The author visited his school on March 12, 1975, accompanied the teacher and two students on a morning field trip and dictated these recollections.

> The Science Club at Logan Middle School is participating in the Project. They test water at two field sites each day, five days a week. I drove with Fred Burdell and two junior high student, Kenny and Katrinka, to Old Town Stream - 10-12' wide by 2' deep. At 4°C air temperature, the team measured water temperature, dissolved oxygen, flow, and sampled for chlorides, sulphates, and pH. In the lab, Katrinka measured pH by color wheel, checked with Kenny, showed results to Fred. Fred made Kenny pipette a 10 ml sample 10-12 times until he and Kenny were satisfied the meniscus was at zero. Fred made it seem like a game and a serious lesson. Both expressed interest and said they liked doing this better than their other courses. Katrinka's mother drove her 20 miles to school this morning to start at 7:30 .m. (school starts at 10:30 a.m. while on split busing schedule) and she missed breakfast. All three computed flow from data and then a transistorized calculator. Fred works with great care so they will understand the procedure in order to get accurate results. He did not, however, labor the technique for information but rather for Kenny and Katrinka to feel they did a good job. Fred had good control over quality but his style would not allow many students to be active and well supervised at one time.

Beyond speculating that both students became fatiqued or lost interest in other courses, there was no evidence that the Project interfered with normal completion of obligations to those courses.

The only controlled study comparing instructional methodologies was made at St. Edward's School. Three teachers used different methods on high, middle, and low-average student groups. With the method described in this Project the low-average students had a higher mean score on a standardized test than more able students taught by the lecture-lab approach. The teachers made this report (graphed data not included here).

> The students participating in the study were freshmen at St. Edward High School in Lakewood, Ohio. They were in Earth Science classes taught by three teachers: Brother David Fitzgerald, David Holian and Nancy Glass. The subject matter was the same for all three classes.

Brother Fitzgerald had the honors sections and the two high average classes. He taught by lecture, slide, overhead and structured labs.

David Holian had the middle average. He began the year with lecture and structured lab but slowly converted to open labs and student involvement in planning of labs and classroom structure.

Nancy Glass had the low-average and low achievers. She used student involved planning and process education methods exclusively.

In June all students were given the same standardized test with the following results:

Class	No. of students	Mode	Mean	Range
Br. Fitzgerald	63	39	27.19	30
D. Holian	131	33	32.76	42
N. Glass	125	27	34.39	40

The students, too, finally had recommendations to submit.

1. Improve the organization of time, assignments, transportation, working space, and equipment availability.
2. Specify additional test parameters and instructions to those procedures.
3. Provide more data interpretation through instructional units, Graduate Students and more experienced high school students.
4. Train more than one teacher:student team in a single school; include more students in the testing routine.
5. Require all Project activities to become part of an accredited course and conduct during the school day.
6. Establish a regular summer training program (one week) for new teachers and students.

The Institute has responded to these recommendations by (1) preparing a "Watershed Heritage Project" brochure which describes the long-term, three-phase Project plan, (2) printing five additional single-page flyers listing the instructional materials, equipment and supplies for each of the Phase I Learning Units and, (3) establishing five summer training sites (Connecticut, Pennsylvania, Wisconsin, Montana and Oregon) to increase the number of teachers and students trained and to add more investigations to those already described.

CHAPTER X

Parents

Parents relate to the Project as (1) overseers of their childrens' general education and (2) indirect objects of their childrens' environmental education. Since the 1967 summer course that originated this Project, parents have mirrored the accomplishments of their sons and daughters. They have been deeply pleased with the Schools' focus on environmental problems, improved interpersonal relationships at home and the childrens' precocious readiness for responsibility. These parents have provided transportation, contributed Project funds, donated equipment and volunteered positive verbal reenforcement.

The parents most obvious commitment to the Project is their trust. They show trust by listening sincerely to student discussions, helping with after-school field work, granting permission for open-ended field explorations and encouraging the students to assist public service organizations that demand responsible behavior and accurate research.

With this kind of backing, students have adjusted rapidly to heavy responsibility. They have written, received and directed federally granted programs. Several have been appointed to watershed commissions and municipal boards. Numerous student trainees have traveled throughout the country as Institute staff to train others. In addition to the many public presentations mentioned at the end of Chapter XI. students have testified before States Attorneys General and several times before the U. S. Congress. While many of these actions took place in the Project's earlier pilot programs, it is logical to predict similar behavior from those enrolled in the five-region Ohio Project.

The promise is in the written returns from thirty parents in nineteen schools. They answered these eight questions:

Q. Has your child seemed to enjoy environmental education and the water testing Project he has been participating in?

Even though a poorly stated and leading question, all parents said "yes" and gave these and similar reasons:

- She likes to work with people and to learn new things.
- He has learned to work with students from the school and to use equipment he would not have had a chance to use if he had not had this opportunity to work with EPA.
- She was learning something new and was putting it into practical application.
- He is more aware of the surrounding area than he was before he joined the Project.
- He has expressed a deep interest in the special projects which the group work on in the lab and stream.
- Because he is interested in the science field.

Q. Has the Project changed his/her attitude toward school in any way?

Eight of twenty said "no", a few explaining, "No, she has always had a positive attitude about school" and "Barbara always had a good attitude and good grades - but it has given her an additional interest and activity." The other twelve described a wide variety of benefits:

- He seems to be more motivated in his studying than he used to be.
- It's really helped in her science course.
- Encouraged study of chemistry.
- His attitude and working habits improved a great deal.
- He enjoyed the course and seemed to think more of advanced education.
- Seems to have enjoyed school more this year.

Q. How do you think it affected his/her grades this year?

Ten parents reported no change. They wrote "still high", "remained high", "always had good grades"; two said, "I don't think it affected his other grades". The other nine made a brief, favorable notation, "did well - helped keep interest", "he has improved his grades in Biology tremendously", or "her grades were excellent." Perhaps most sensibly of all, one wrote frankly, "Too many other variables to evaluate." No parent, compared to 4% of the students and one of the teachers, reported a drop in grades.

Q. Does your child use more outside resources for his/her school work as a result of this class?

An equal number of parents thought their children used more resources and mentioned the library, science, fairs, and other related school functions as did those who thought the students did not. A few qualified their answer with a "probable" or "doubtful".

Q. Has this program placed any additional burden on you as a parent? Please explain.

Eighteen parents wrote "no". Two added, "just making sure she could get to some of the night meetings" and, similarly, "only the transportation to and from Ohio State University. The nineteenth said the program was an additional burden - "answered these questions!"

Q. Have you noticed any change in your son's or daughter's education or career plans that you think are a result of taking an environmental education course?

Most responses distinctly conveyed indecision and several added, logically, "No, she's in the 7th grade, a bit young for career plan still." However, they responded gamely:

- She probably is giving some thought to some area of environmental study in the future
- He wasn't quite sure of his future; now I think he is leaning toward science.
- It has strengthened his desire for higher education.
- Plans were for environmental education before the program. This affected his work in the program, not the other way around.
- She enjoys science much more. She is planning to use her gained knowledge for a Girl Scout Project. I know she plans to go to college but her career is undecided so far.
- No change. This course served to maintain her interest in science and laboratory work.
- Yes, however seventh graders have a long time to change and re-change their minds about life-long careers.

Q. In what ways do you think this program has been beneficial or detrimental to the students involved, the school or your local community?

Eighteen of the nineteen answered in this fashion:

- For those interested it provides an opportunity to get out and do something in the field - very important I think.
- Students are very much aware of problems.
- He has definitely enjoyed the Project and it is something very much worthwhile.
- Practical experience and chance to work with others on a project which can have future orientation.
- This program gets him involved in something that he likes to do. This course helps in all ways.
- May help community stay aware of problems in Rocky River.
- There was local press coverage at the beginning of the program and it's rather exciting to the students to be part of an area-wide water analysis.
- I feel it has been beneficial to the student and teacher - no great amount of publicity has been given at school or to the community.
- It has made him more aware of the importance of our natural environment.
- She has been involved with more activities as a result of this course.
- Beneficial to students - application of knowledge to a real-life situation.
- Beneficial in information passed on to others concerning water pollutants.
- Very beneficial to the students because they are learning through actual experience. The school can be proud of their students and the community will benefit from the results of the Project.
- Beneficial to all as today's students may find solutions to environmental problems in the future.
- The program has been beneficial in that my son has been exposed to another area of study which he probably wouldn't have in any of his regular classes.
- I enjoy learning new things from my son.

Q. Has there been any change in his/her behavior at home, school or with friends that seems to be a result of this activity?

One half of the respondents replied in the following manner; the other half did not comment:

. She has a better self image.
. Possibly a keener sense of responsibility.
. Possibly, because he accepts responsibility more readily.
. He is more aware of pollution and how to help the situation.
. He seems to care more for the environment now, not wasting like he used to.
. Family and friends have been made more aware of environmental problems even to the point of visiting the creek assigned and examining specimens.
. Has made more friends.
. Gave him an outside activity and chance to work with others.

The replies from parents were not satisfactory in depth or precision. It is likely that the method of administration was extremely selective, depending upon the follow-through of interested teachers, the accompanying explanation and the interest of the parents. No doubt a good many of the critical statements were not returned or were simply omitted; therefore, this method of assessment probably determined the preponderance of favorable remarks.

In their closing, voluntary remarks, however, they summarized the collective reasons why all of the parents favored the Project:

. Sylvia's teacher, Mrs. Rea, has been the chief reason that the whole experience has been so positive for Sylvia. She's quite a teacher!
. I'm grateful my son has had an opportunity to be involved in the program.
. This activity fit in well with her past interest. Field work is very important to give students a chance to translate book knowledge into action.
. This program tends to make these young people more responsive to the need to work for society.
. She has enjoyed this opportunity and quite willing to work at the project.
. We are very proud of our daughter for taking an active interest and following through with this project. We also are very happy that she has a teacher that is interested in the students and the extra time he gives for their benefit. This experience, during the year, and the opportunity to work with Ohio State University and teachers and other students has helped and will help her in the future. A great growing experience.
. I am surprised that there weren't as many involved in this project - maybe next fall there will be more signing up. I would be very disappointed if the project was cancelled due to lack of interest in the school body.

CHAPTER XI

Observers

The attempt to solicit information from persons not directly involved with the Project was not very productive. The hope was to compare observer perceptions with those involved in other roles, i.e., graduate students, teachers, students and parents. This technical aspect is discussed in the Evaluation Section while the findings are briefly reported here.

There were ten completed forms returned - five by Department Chairmen of member schools, three by Administrative Heads, one by a teacher assigned to an adjacent room and the last was a father.

The observers responded to four questions.

Q. In what ways does this course appear to be different from the other classes you know of?

- Laboratory aspect
- Outside work, practical applications, solving real problems
- It is a special group of science students under the guidance of Mr. Madaffer who are interested in environmental conservation. It is on a volunteer basis and the group meets after normal school hours
- More independent study and freedom to learn
- Stand waist deep in water for class
- A small group of 10 students within the regular class has been working with the environmental project; therefore, this is a supplemental program for these students. These students are serving as consultants to four classes who are planning a weekend outdoor environmental campout
- There is an application of the study of the environment utilized in the classroom. This makes the knowledge obtained more relevant to the student. As he performs his stream study on Turkey Run he realizes that his learning in school is applicable to his immediate surrounding.
- This class is not highly structured and it seems to be a self-directed program. Once a student is aware of the procedures used in water testing he is able to work on his own and use ideas of his own to aid in the program
- It is a combination of class work and the actual doing of what is taught
- It helps people other than from the school - more enjoyable.

The interpretations vary with each observer which - in one sense - is similar to the diversity of interpretations reported both by students and their parents. This may be a confirmation that either the program really is diverse and/or that communications about its purpose, process and daily operations are not yet sharply delineated.

The Institute has taken the position that the work to be performed for the Ohio EPA is explicitly stated but that the process for accomplishing the work within the constraints of the school's budget, schedule, academic curriculum, geographic location, teacher skills, student interest, etc., is yet to be developed. The purpose of the three year development plan is to define the best operating model.

Q. Do you think the idea of environmental education is a good one? Why or why not?

- Yes, interest is easily developed because of vital aspect of the problem. The children hear of environmental abuses in all the media - thus are stimulated to action
- Very good!! For reasons mentioned (outside work, practical applications, solving real problems) and the opportunity to meet other students involved in the same work and occasionally to meet with experts in water chemistry
- Yes, a good way to disseminate information to the public
- Yes, in order to better understand the world we're botching up
- Students involved in this Project appear to have become more cognizant of our total environment. They have developed a conscientious concern for society's need for quality water. A by-product of the Project has caused some of these students to be more productive academically
- Yes, a student becomes aware of problems existing in the environment and, as he participates, he personalizes these problems. In future years, he will identif more with the research and have greater understanding of the difficulties encounte
- This type of course not only gives the students some educational experiences they would not otherwise have but it also makes them more aware of the problems facing their environment
- Yes, environmental studies will be a very important phase of our society in years to come
- It is good because it's up to people of the community to take action. The government isn't doing enough.

Surprisingly, most observers mentioned the environmental rather than the educational significance of the Project. They did not see the Project as a process, first, which could deal with a subject, second. Probably the observers are accurately reporting the narrow range of investigations selected for the first year's focus.

Q. If you were teaching environmental education how would you change what this class is doing this year?

Six of the ten observers would not make any changes or they felt unqualified to prescribe. The other four, three of them Science Department Chairmen, made these recommendations:

- Expand the course to a complete aquatic study
- One would necessarily cover more aspects of the environment than water testing even though this is a very important one
- I would attempt to acquire some more equipment and material to carry out water testing. Since this is not financially possible through school budgets, I would hope that material might be obtained through other sources.

- Be able to involve more children.

These suggestions are consistent with those made by teachers, students and parents in this and other reports.

Q. In what ways do you think the environmental education, or water testing program, has been beneficial or detrimental to the students involved, the school participating or the local community?

- The program's benefits were mentioned. The only problem I see is that we are unable to physically get enough students involved. This problem arises from the fact that the course is only offered after school hours
- It has been beneficial because the students have learned 'firsthand' what is happening today
- Beneficial - students learned the hows and whys of water testing including working under adverse conditions
  Detrimental - they almost ruined my only pair of waders
- It has given the students involved a good experience in an aspect of conservation. They have learned experimental techniques associated with the problem and have realized the importance of the program. As I have indicated above, it was also beneficial to people from other communities which did not have the program available as well as our local community.
- I believe it instills the following characteristics:
  1. love of country, i.e., land, rivers, streams, mountains, etc.
  2. respect for others
  3. higher person morale - 'helping others'
  4. personal responsibility to get job finished
- Beneficial in all ways mentioned. This type of course may help draw the local community and its school closer together in terms of the roles of the schools and the community
- The water testing program has certainly been beneficial to the student, the school, and the community. The student learns of water contamination, movement, testing programs and the need of water purification. The school benefits as the student participates in a learning situation and gains as the students relate their experiences to their environment and to their communities
- It has taught them something to help the community and to help them later in school. From this the community might be influenced a lot more.

Observers include the media, student bodies, boards of education, the faculty, agency staff, professional associates, civic club members, test site landowners, law enforcement personnel and many other categories of persons who see students, read reports and in some way are related to the Project. Project teachers and their students have made dozens of presentations. Newspapers have heavily reported activities in all five regions, U. S. EPA distributed 6,000 special educational issues on the Project, the Canadian Film Board included scenes in a TV documentary on the Great Lakes and many visitors from other parts of the country have witnessed the operations in Ohio. Even international observers have seen the Project demonstrated in Spokane, Washington, at EXPO '74.

These audiences have unfailingly responded with enthusiasm, approval, requests for additional information and many with initiatives to begin similar activities themselves. This report will be sent to many of them.

CHAPTER XII

Dissemination

The "Watershed Heritage Project" will be disseminated by (1) national promotion, (2) summer training courses and (3) continuous mail-order services.

Full scale promotion began in Washington, D. C. January 30, 1975 with an announcement by the Department of Housing and Urban Development Secretary Carla A. Hills, Congresswoman Mrs. Hale Boggs and John W. Warner, Administrator of the American Revolution Bicentennial Administration, that the Project was chosen as one of two hundred in the United States reflecting exemplary community achievement to be recognized throughout the Bicentennial year (January - December 1976). The press announcement was mailed that date to 1400 public media radio, television and newspaper offices. During 1976 a broad variety of regular and periodic newsletters, catalogues, press releases, public displays, films and clips will carry out the story of this (and other) Projects, inviting requests for information which will lead to site visits, personal contacts and ultimate replication.

A second and smaller scale national announcement will be made. On March 10, 1976 the Xerox Corporation's Education Division will feature the Project in "Current Science" which is read by 800,000 secondary school teachers and students. The issue will contain starting field studies and recommend inquiries for sequel Learning Units to the Institute for Environmental Education.

In answer to inquiries generated by these two announcements, the Institute will mail a six-page brochure which outlines a plan leading to incorporation of the water quality program. The brochure outlines the three Phases:

Phase I - instructional units for water quality analysis of a small local stream, emphasis upon skill development

Phase II -sequential units and workshops relating community history to water resources; emphasis on investigation and understanding

Phase III-summer and inservice courses for qualified teachers and students creating a community centered watershed study and management program; emphasis on service.

It then details the five Learning Units of Phase I

Unit 1 Stream Biota
Unit 2 Dissolved Oxygen, Temperature and pH
Unit 3 Fecal and Total Coliform
Unit 4 Stream Flow
Unit 5 Mapping

Each Unit consists of written teachers guides, audio-visual, self-instructional student kits, hardware and resupply packets. The materials and equipment in each Unit add progressively to the completed, class-size Phase I. Material sources and prices are listed in accompanying flyers. Unit I introductory guides permit teachers to begin the Project without further training.

However, formal summer training courses for Phase I Units will be offered at five locations during June - August 1976. Phase II and III training will follow in later summers. The final number of training centers depends upon demand.

Mail-order services include year-long communications among participating schools with reports of new procedures, materials, equipment. Direct, personal technical assistance can be requested, such as workshops, fund raising help, coordination with environmental agencies, etc. Mail-order and consulting services are already in operation.

Costs of all five Phase I Learning Units total approximately $600-750, if components are purchased through the Institute's recommended sources. These may be acquired separately or as a complete package. The summer training fee includes instruction, room and board, plus the five Units.

Schools might allocate money from exisitng line items or, preferably, students may raise some agreed percentage. Fund raising is an opportunity to reenforce involvement, foster an activity, reflect pride, and build practical social and communication skills. Group decision-making,accounting, reporting, interaction with grantors are all invaluable learning options not usually associated with a school curriculum. When a school volunteers authority to Project students to deposit and expend monies from a reserved line item it goes a long way toward gaining their partnership.

During 1976 local Bicentennial Commissions are being asked through the national offices of the American Revolution Bicentennial Administration to consider a small number of Projects for community introduction and support. The "Watershed Heritage Project" is one of them. Intercommunications between Commissions and schools are recommended. The Institute mails suggestions on how Bicentennial Commissions can assist the schools on request either by Commissions or schools. These suggestions include:

1. Explain the Project and its educational and social goals to school administrators, teachers and students.
2. Establish a Bicentennial Task Force to facilitate the schools' participation.
3. Offer to generate a small match grant to start the Project and then provide advisory assistance on fund-raising to students.
4. Encourage a nearby university to loan a graduate student to coordinate field and laboratory instruction.
5. Identify and contact technical resource persons, public media representatives and transportation volunteers.
6. Link the student program to area planning commissions, watershed agencies, civic leagues and other groups who need environmental information - when the schools are appropriately qualified.
7. Arrange a summer training course for teachers and students wishing advanced training and field experience (contact the Institute for Environmental Education for details).

After the Project has been adopted, the public media can be and have been most generous in spending time with teachers and students in the field and laboratory, fairly and accurately representing their educational mission without distorting their fact-finding objectives. A fear of name-calling or misrepresentation of pollutant sources has not been realized, no doubt through the care teachers and students have taken to describe the Project clearly to media writers and reporters. Publication in newspapers, appearances on radio and television programs as well as numerous conferences have all contributed to the overall dissemination plan.

Examples of newspaper releases, case histories of technical reports and continuing Project news is available from the Institute for Environmental Education, 8911

Euclid Avenue, Cleveland, Ohio 44106 (216) 791-1775. A $15.00/year membership subscription contains announcements of workshops and summer training schedules, new activities and information to assist schools in disseminating their accomplishments within their own communities. And periodically the Institute announces major Project developments to an active mailing list of approximately 3500 teachers.

CHAPTER XIII

Adoption and Implementation

There is a trend in education which favors the adoption and implementation of environmental activities. The trend is implicit in programs categorized as "career education", "comprehensive education", "applied sciences", "independent study" and a host of other titles. Usually these titles are functional titles and convey the suggestion that students will be in direct contact with employed persons, industrial production and research technology. All of these programs move from text-based science history and planned laboratory experiments toward reality-based problems and future careers. Environmental education is a process which leans in these directions and its probability of adoption and implementation is increased in proportion to acceptance of the overall trend.

A number of factors are behind this shift from theoretical to applied studies. Four are pertinent to this Project especially. One factor is the theory which proposes teaching linear thinking (left hemispheric locus) with spatial integration (right hemisphere), a technique developing about the learning physiology described by Robert E. Ornstein in The Psychology of Consciousness (W. H. Freeman and Company, San Francisco, 22 243, 1972). Learning structured to encourage interaction of both brain halves may heighten student interest, achievement and concept formation. Ornstein writes:

> Both the struction and the function of these two 'half-brains' in some part underlie the two modes of consciousness which simultaneously coexist within each one of us. Although each hemisphere shares the potential for many functions, and both sides participate in most activities, in the normal person the two hemispheres tend to specialize. The left hemisphere (connected to the right side of the body) is predominantly involved with analytic, logical thinking, especially in verbal and mathematical functions. Its mode of operation is primarily linear. This hemisphere seems to process information sequentially. This mode of operation of necessity must underlie logical thought, since logic depends on sequence and order. Language and mathematics, both left-hemisphere activities, also depend predominantly on linear time.

> If the left hemisphere is specialized for analysis, the right hemisphere (again, remember connected to the left side of the body) seems specialized for holistic endeavor. This hemisphere is primarily responsible for our orientation in space, artistic endeavor, crafts, body image, recognition of faces. It processes information more diffusely than does the left hemisphere and its responsibilities demand a ready integration of many inputs at once.

Teachers who recognize a right-left hemispheric learning model might organize student learning situations differently, building upon the reenforcing effects of both brain-half capabilities. Mixtures of logical and intuitive experiences, juxtaposition of facts with postulation of concepts, even the consideration of sequencing might become important. In this last respect, for example, Robert Samples writing in "Essentiasheet" (No. 3, Fall 1974, The Evergreen State College, Olympia, Washington 98505) noted the precession of holistic before logical thinking during a problem-solving session:

> Young children - if not intimidated by adults - nearly always started solving problems with intuitive, metaphoric, and analogic excursions. That is they would play with the problem rather than reason with it. It mattered little if it involved apparatus, lab equipment, natural materials, or words ... when they tired of this they snapped off their metaphoric mode and took a hard analytical look at the object or problem. It was at this stage they began asking questions like, 'What is this? ... How does it work? ... What do you mean?'

More recently some dualities of the mind and their relationship to science teaching were suggested by David H. Ost and David George, "The Contradictory Faces of Science" (The Science Teacher, Vol. 42, No. 10, December 1975). They gave examples of seeming contradictions such as "analysis vs. synthesis", "completeness vs. incompleteness", "objectivity vs. subjectivity", "value-free vs. value-laden", "product vs. process". They said about the first:

> Analysis and synthesis in science occur simultaneously. Each is a necessary part of the other. Arriving at an accurate picture of some natural phenomenon requires that each part be understood separately (by analysis) and as a part of the whole (by synthesis).
>
> Rarely are students of science ever helped to recognize the dualities and ambiguities we have described. Understanding them, however, would undoubtedly increase student appreciation for the totality of science and for its role in daily life.

Fortunately, the words and workshops of these men continue. They strenghten prospects for environmental education.

A second factor which facilitates adoption of environmental studies is the increasing suitability and availability of materials which do integrate left- and right-half cerebral functions. The lack of appropriate materials was warned by Michael J. Naylon in 1970. In The American Biology Teacher (Vol. 32, No. 7), he presented this picture of the support system for interrelating theory and application:

1. 77.9% (of the respondents) indicated that (i) no curriculum guides were available that integrated other subject areas, (ii) no specialist assistance was available for curriculum development, and (iii) no provision was made for regular revision of curriculum guides.
2. 50% indicated that there was no specific time allotted for the study of environmental science or that the time allotted was inadequate.
3. 31.6% indicated that the content of a general textbook served as the sole source of study.
4. 42.9% indicated that science content was confined to the study of plant and animal life identified in the adopted general-science textbook. Textbook selections were made to appeal to very broad audiences: their appropriateness to local situations was questionable, in many instances.
5. 77.4% indicated that evaluation of pupil performance did not include measurement of ability to structure inquiry, maintain data records, formulate and test hypotheses, or arrive at conclusions. Respondents also stated that there was no provision for evaluating concept development.
6. 84.5% indicated that there was no consistent pattern of required inservice development applicable to their specific needs. Furthermore, only 11.7% stated that a formal, school-sponsored inservice program was available to them.

Distressed, he summarized his interpretations of the attitudes which pervaded education at that time. The principal ones blocking implementation of environmental education were:

1. Educators still tend to 'catalog' environmental-curriculum materials under 'science'. This reinforces the very educational process that has not been effective in the past. It almost always imposes a strong biologic emphasis that it is not necessarily ecologic. It makes the task of developing an integrating curriculum all but impossible.
2. Few schools are committed to implementing programs that include (i) more flexible daily schedules, (ii) modification or integration of curricular subject matter, and (iii) greater freedom and the increased involvement of students and citizens in planning programs.
3. Persistence in removing the child from his real environment and transporting him to wildlands or nature centers where he is taught the environmental mechanics of a nonsocial Nature. These ventures are costly to the public, are not sustained long enough to provide significant changes in attitude and do not meet the immediate need for socioecologic understanding.

Six years later virtually every major publisher has some environmental education material from which an astute teacher might be able to pick and choose combinations of activities which will engage the full learning potential that Ornstein's model promises. Few publishers, however, have understood the importance of the model and built deliberately about that design: Samples states that the Environmental Studies materials (ESSENCE) "try to take a significant though small step in the direction of encouraging the use of both hemispheres of the brain".

In addition to ESSENCE, the National Science Foundation is supporting a program that attracts students into continuing their education through experiences of special interests. Some seventy-five schools are testing "Unified Science and Mathematics for Elementary Schools (USMES)". The USMES approach is to provide learning motivation by engaging students in "real, current meaning for students, and with the reenforcement of practical accomplishment. The learning mechanism: their own innate eagerness to find things out, to do, to succeed. The means: providing them with simple, basic resources to answer their own questions as they arise in their attempts to solve problems" (Mosaic, Vol. V, Winter 1974, U. S. National Science Foundation, Washington, D. C.).

A third force hastening adoption of curricula that have real world focus is the fear of unemployment. The underlying thesis is that high school graduates have greater employability and income earning potential than dropouts. Education USA (Vol. 17, No. 26, Feb. 24, 1975, summarizing A Target Population in Adult Education, U. S. GPO, Washington, D. C. 20402, 157 pp., $2.35, No. 5203-00047) concludes:

> High school graduation alone was enough to provide average incomes double those earned by people with less than eight years of schooling. In 1972 the average income for people with seventeen or more years of education was $17,346 while the average high school graduate earned $10,433.

While the gap is narrowing, as later studies indicate, and many PhDs are out of work, the report points out that of the 54,000,000 adults in the target population only 1% earned more than $15,000. The summary concludes that "Adults who try to get ahead without a basic education are fighting tremendous statistical odds ..." The

Administrative branch of government is now acting on these findings. U. S. Commissio of Education (HEW) Terrence H. Bell, at the February 1975 meeting of the National Association of Secondary School Principals in Las Vegas stated there is a need for "a more comprehensive education for each student through increased learning options in the school and the community "(Education USA, Vol. 17, No. 24, February 17, 1975)."The principals reported in This We Believe: A Task Force on Secondary Education, that "Studies say that student activities correlate more highly with success than do grades!" and "Little personal growth comes from being a nonlooker!" Bell added that U.S. Office of Education will review the principals' recommendations and prepare their own priorities.

One application of comprehensive education is found in the U. S. OE experimental "career education" programs which provide increased interaction between school and community. Anthony LaDuca and Lawrence J. Barnett in a critical review entitled "Career Education: Program on a White Horse" (Education Digest, Vol. 40, September 1974) describe a career education plan developed by the Ohio State University Center for Vocational and Technical Education. The Center's model promotes career awareness (kindergarten through 6th grade), career exploration (7th - 9th grades), and career preparation (10th - 12th). Interpreted in the State of Ohio the Board of Education's Bureau of Vocational Education views career education as a K-10th grade program, describes seven areas of study, one of these is environmental studies, and activities include a community rather than a text book focus. The federal career education grant application criteria (Federal Register, Vol. 40, No. 231, pgs. 55659-55663, December 1, 1975) include experimentation with curricula that bring students into close contact with community situations, i.e., employed adults, their feelings, skills and knowledge. Appropriations have already made grant awards possible to foster exactly the kind of interactions that are essential to supplementary learning systems such as the "Watershed Heritage Project".

In Oregon the first state-wide performance-based system requires demonstrated competency from 9th-12th graders in three areas: "personal development, social responsibility and career development. These areas must include the ability to handle real life experiences such as being able to change a tire and balance a checkbook". To qualify for state aid, districts must show they have programs which "equip students to survive in the society in which they must live; provide electives based on student needs; develop record-keeping systems that enable a student to keep track of progress toward competencies; provide for early or delayed graduation if a student wants it; provide off-campus instruction and alternative learning processes and provide certificates of competency for a student who does not qualify for a diploma spelling out the competencies he has achieved." (Education USA, Vol. 17, No. 37, May 12, 1975).

A number of other states are examining some of the federally sponsored environmental courses. Project KARE in Philadelphia, U. S. OE Title III five-county support agency, is demonstrating and disseminating its findings during 1976 to schools and communities throughout the United States (American Education, January-February 1976). Their workshops include materials and procedures developed during the Institute's earliest teacher-training efforts in New Hampshire in 1969-70, later under grants from the Office of Environmental Education and which include comprehensive incorporation of applied research in environmental problem-solving.

Individual school district or class examples are too numerous to include here. In Ohio alone the Department of Education's Adaptation Grants Program (Ohio Facilitation Center, Room 908, 65 South Front Street, Columbus, Ohio 43215) provides funds to help teachers adapt Title III environmental education materials in some 25 districts. Some of these materials are heavily process-oriented and include many community-related applications to environmental studies. This kind of example could be cited for many states.

In summary there appear to be ample Federal, State, and local commitments to incorporate the form of environmental education described in this report.

The fourth factor increasing the liklihood of hands-on education in secondary schools is that the advocates are gradually learning how to design, distribute and sell new ideas. Both governmental agencies and the curriculum developers are learning the hard way - either they did not heed warnings such as Naylon's or they did not have the knowledge to respond. Just how much knowledge is required W. W. Charters, Jr. discovered in a study of four U. S. Office of Education programs and reported in The Process of Planned Change in the School's Instructional Orgnaization (CASEA Monograph No. 25, Center for the Advanced Study of Educational Administration, University of Oregon, Eugene, Oregon, pp. 126, 1973). He wrapped up the problem:

> Generally speaking, educators seriously underestimate the enormity of the task of effecting fundamental change in schools and funding agencies seem to reinforce, indeed, compound the error by imposing time deadlines, evaluation schedules and budget restrictions which imply that complex organizations can be transformed virtually overnight. Together, the educational planners sometimes act as though all that were required to implement major innovations are serious intentions and a few summer workshops. Such views clearly need modification.

Charters and his co-workers investigated the planning and implementation process in four U. S. OE-funded programs. They discovered three primary sources of implementing problems. The first centered about pre-existing incapabilities of schools which led to assumptions about organization, management control, grant requirements, preparedness of teachers, problem resolution, decision making and other identifiable facets of managerial technology - all of which ultimately turned out to be invalid! The second source of implementation difficulties were the vulnerability of new ideas and novel practices in schools, which were defenseless before teachers' insecurity, doubt, uncertainty, fear caused by PTA attacks, interunit jealousies and hatreds and resulted in a desire to concede and apply standardized procedures. And the third problem was that after the first massive effort to initiate the new system the participants halted half-way through in defeat and exhaustion and declared the program incorporated.

The authors conclude, "two impending axioms are once again brought into light: the probability of nonfulfillment is great and knowledge of how to implement, if it exists, is a well-guarded secret." Unhelpful as this statement is directly, it nevertheless has cautioned the innovators. Hopefully they will study the results of the more recent Rand Corporation report.

The Rand Corporation's report, abstracted by Education USA (Vol. 18, No. 2, September 1975) found that when school districts saw a real problem they won the support of teacher, principals or administrators. With this commitment projects were mutually adapted: the schools changed, the projects changed. The study found that:

> The most important elements were high teacher morale and willingness to do extra work and the support of principals, as well as district officials. If teachers see they are getting support from each other and from administrators, they are being told that they can 'afford' to take the project seriously.

The following implementation strategies were important in promoting teacher change especially: "adaptive planning, staff training, local materials development and the establishment of a critical mass of project participants". Further study of this report by innovators and adopters might be crucial to schools considering this or any new program.

Teachers, too, will need to learn how to innovate. There is a strong resistance to change, primarily because school administrators and teachers believe that control over students will be eroded. An excellent case history of one innovator, which parallels the evolution of this Project, is William Romey's (Risk-Trust-Love: Learning in a Humane Environment (Charles E. Merrill Publ. Co., pp. 279, 1972). Some specifics for teachers are contained in "How Teachers Can Innovate and Still Keep Their Jobs" by Larry L. Palmatier, University of Utah (Journal of Teacher Education, Vol. XXVI, No. 1, Spring 1975). Somewhat tongue-in-cheek, he lists ten prescriptions for the innovative teacher:

1. Keep the door closed - innovate quietly without fanfare.
2. Use a special vocabulary - use "mastering basics" not "fun".
3. Identify allies among your colleagues - seek a respected faculty member to publicize your idea.
4. Enlist the students in your game plan - to avoid student comparison between teachers and to gain involvement.
5. Learn from others - listen openly, share their ideas.
6. Carry a book - keep informed, well-read, know what you're doing.
7. Get visibility - get program recognized outside school.
8. Get outside support - generate outside funding sources.
9. Start regular discussions with other teachers - meet regularly.
10. Start a library and set up a class or workshop - on institutional change.

Other studies on change in the classroom can be helpful to administrators and teachers alike and should be included as part of all new program training courses.

These four factors - a new learning model, appropriate instructional materials, sharpened focus on career preparation, and more sophisticated implementation strategies - are among others that are helping to create the favorable circumstances in which activity-centered projects can flourish. We hope the "Watershed Heritage Project" is one of them.

APPENDIX TO CHAPTER VI, EVALUATION

Instructions to the five graduate student coordinators for administering questions to teachers, students, parents and observers. Copy of questions asked of each group.

Instructions to the Graduate Student Regarding the Enclosed Questionnaires

Dear ________________________________

This instruction is being given to guide you in distributing the enclosed questionnaires and to give you some information on the intended function of this survey.

Enclosed are five (5) sets of questions:

(1) For teachers participating in the water testing project.

(2) For students involved in anyway with the program.

(3) For those people who have observed or in some way had contact with the program (i.e. school administrators, teachers who are not a part of the program, OEPA officials, concerned citizens, etc.....).

(4) To be completed by parents who have children participating in the water testing, or the environmental education program.

(5) For you to fill out.

These questions are designed to reflect some of the educational processes taking place during an environmental education program. We would like to have as many viewpoints as possible. The results of this survey will provide Joe Chadbourne and the I.E.E. staff with their main source of information for writing the required documentation of this project for the U.S. Office of Education.

Please distribute these forms as quickly as possible after receiving them. We would like each of the teachers involved to receive a form. We realize that some of you are covering a large area with many schools involved, such as Jane Adams in Columbus. If this is your case, use your descretion on what you think would be a representative sample of students. For categories (3) and (4), those people who have had some direct contact with the program will probably be the best source of information and the easiest to reach. At one school those to whom you distribute form (3) "observer," may have entirely different roles than those you feel could best provide this information at another school.

We have tried to construct open-ended questions since conducting personal interviews with each participant would be impossible. However, wherever you think it is possible to personally interview teachers, students, parents, it would be invaluable since you could ask some follow-up questions. Any related interviews, or observations that you have independently documented would be greatly appreciated.

Please return the completed questionnaires not later than ______________1975.

Sincerely

GRADUATE STUDENT

I. Do you like this program?

How do you view your role to be?

How does this function differ from other jobs you have has a teacher, scientist, coordinator etc...?

II. Has this work changed any of your career or educational goals? In what way?

III.
a. Is this project in any way different from other courses or programs you have taken, taught, or observed?

b. Could you briefly compare the different approaches takne in the field and in class by the different schools you are working with?

c. Are there any problems, pitfalls or obstacles common to each class involved in the program?

d. What steps have been taken to modify or expand the class or field work?

IV.
a. What benefits can a teacher or student get from a program similar to this?

b. Have teacher and student interest in this program diminished or increased during the year? Can you offer an explanation for this?

V.
a. Do you think the kids involved in this program are getting "educated"?

b. What kinds of things are they learning?

VI.
a. Do you think this program is likely to be expanded at any of the schools you are working with? Why?'

VII.
a. Can you breifly state how you evaluate the success of a program at each school?

TEACHER

SCHOOL ______________ COUNTY ______________ GRADE LEVEL ____

Dear Teacher: Please answer the following questions as completely as you can. All additional comments will be appreciated. Return this sheet with your students completed questionnaires to the grad student coordinator. Use the back of this sheet for writing space if necessary

I. a. How long have you been teaching an environmental education curriculum?

II. a. Is this course different from others you have taught?

b. In what ways?

c. What made you begin teaching this kind of course?

III. a. How did you change your teaching method, relations to students, other teachers, etc... to suit this course?

b. Was the change from any previous science or related program made gradually or immediately in your class or school?

c. What steps did you take in making the transition?

d. What made the change easy or difficult?

e. What changes would you make in the future if teaching this course?

IV.

V. a. Is this a multi-disciplinary program?

b. Are you having other classes work with you?

VI. a. Do you have a course outline?

b. What are some of the topics you are studying in your class?

c. Are specific times allotted for each class throughout the year?

d. How did you design your course?

e. Name the people, references and resources you used in developing your curriculum?

f. Were any new topics introduced for inquiry that you hadn't initially formulated?

g. How did they come up?

h. Please list some student project titles and describe some papers and projects if any were done by the students?

VII

VIII. a. What did you base your students' progress and learning on?

IX

X What did you learn about yourself from this program?

Any Additional Comments? THANKS!!!

STUDENT

SCHOOL ____________ AREA ______________ GRADE LEVEL ____________

Please answer the following questions the best you can, all comments will be appreciated.

I. a. You are taking an environmental education course. What do you like best about this way of approaching learning?

b. What do you like least?

II. a. Is this course different in any way from the others you have taken? How?

b. Why did you take this course?

III. a. In what ways is your work in this course different from that in other courses that are more traditional?

b. Do you have a text book for this class.

c. How necessary is it?

d. Does your teacher lecture in this class?

e. Do you have class discussions or planning sessions?

f. What portion of your time devoted to this course is spent in independent study?

IV. a. Did you like this course?

b. What changes in your knowledge and skills have resulted because of this course?

c. Are you more involved with your school or community because of this course? Why?

d. Did your grades in all of your courses go up or down this year? Do you think there's a reason for this?

e. How is your relation to the teacher or other students in this class different than in other classes?

f. Why do you feel more or less capable of investigating and solving problems as a result of this course?

V.

I a. Did this course seem well organized to you? Is that necessary?

b. How did your class select the topics studied this year?

c. Did you work on an independent or group project?
d. What was its title and how was it selected?

e. What resources did you use for the project?

VII

VIIIa. Were you tested or graded on the knowledge you gained in this course?
b. What do you feel is a valid way to judge what you have learned in this course?

c. List the things you based your progress and learning on?

IX a. Do you feel you will be more successful in colege or at a job as a result of this course? Why or why not?

b. How has this course changed any of your plans for your future education or career?

X. What specific skills have you learned (interviewing, chemical tests, writing, etc)?

XI What have you learned about yourself from this course?

Any additional comments? Thanks.

PARENTS

SCHOOL ______________ COUNTY ______________ SON/DGHTRS GRADE LEVEL__________

IV. a. Has your child seemed to enjoy environmental education and water testing project he has been participating in? Why? Why not?

b. Has it changed his/her attitude toward school in any way?

c. How do you think it affected his/her grades this year?

d. Has there been any change in his/her behavior at home, school, or with friends that seems to be a result of this activity?

e. In what ways do you think this program has been beneficial, or detrimental to the students involved, the school, or your local community?

f. Does your child use more outside resources for his/her school work as a result of this class?

g. Has this program placed any additional burden on you as a parent? Please explain.

IX. a. Have you noticed any change in your son or daughter's education or career plans that you think are a result of taking an environmental education course?

Any additional comments?

Thank you for your help.

OBSERVERS

SCHOOL ________________ AREA _______________ GRADE LEVEL OBSERVED _________

What is your occupational title?

What is your relationship to the class doing water testing?

II. a. In what ways does this course appear to be different from the other classes you know of?

b. Do you think the idea of environmental education is a good one? Why or Why not?

c. If you were teaching environmental education, how would you change what this class is doing this year?

IV. a. In what ways do you think the environmental education, or water testing program has been beneficial or detrimental to the students involved, the school participating, or the local community?

Thank you for your Cooperation!!!!!

END